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ANTS IN INK

By FRANK A. FRENCH

When I started a letter at my desk in the den of our Florida home one evening every dip of the pen brought up something like a thread of hair. Wiping and changing the pen failed to help. Then I noticed several very small ants, one on my wrist, another on my thumb and one on the penholder. All were traveling from the direction of the pen point.

What possessed me to look down into the ink I do not know, but I did, and there were some three hundred of the minute little beings, all on the surface of the ink; all wiggling and all in a mass at the center. For a full minute I watched them through my reading glass. They were doing their best to survive the rigors of a small sea of green ink one-half inch deep.

Having left the cap off the bottle the night before, I solved the mystery of how they got there. But the question of how they would survive remained for the future. Shifting to a bottle of blue ink, I finished the letter, and, a half-hour later, the ants were still active. They appeared to have formed a raft of their bodies, with most of the heads out of the fluid. Shaking the bottle gently did not separate them. Wondering how long they could survive, I screwed the cap on the bottle and left them.

The next morning they seemed as active as before, more so, in fact, because some began to climb out and down the side of the bottle. They crossed a piece of white paper, leaving a fine line. I was determined to see how long they could survive, and found, the following morning, that there was still a solid, struggling mass about the size of a dime, although the number seemed to have decreased about one-third. The next morning I fished out some with a blotter, and inside of a couple of minutes a half dozen of the rescued were on their way for new adventures. With the strip of blotter I got about thirty more, and fully two-thirds of these were soon able to travel away. Several were noticed to turn around and then come back to the group trying to untangle itself, as though there was a message to impart. Imagine being able to walk away after sixty hours in an inky ocean!

Herpetologica

Herpetologica is the name of a journal devoted to all phases of the study of reptiles and amphibians. Its aim is to help beginners by publishing their early efforts without delay, as well as to publish technical papers by professional workers. It would be glad to sponsor any club or organization specializing in herpetology. It is managed on a non-profit basis. Write to Major Chapman Grant, 2970 Sixth Avenue, San Diego 3, California.

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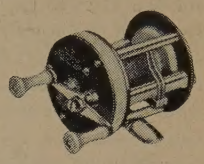

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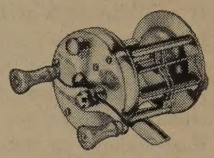

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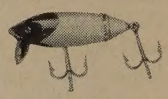

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Nature in Print

By HOWARD ZAHNISER

EDWIN WAY TEALE recently commented on what he called the "particular excellence" of my "referring back to some of the standard works about South American natural history" in June-July, and was gracious enough to say: "Many of the readers of the magazine will be unacquainted with the older books and such a linking together of new and old seemed particularly effective." Mr. Teale's letter suggests to me anew the monopoly that the currently published books do have on the writing time of anyone who would try to discuss this subject of "Nature in Print," and sometimes the monopoly seems unjust. It reminds me, too, of the question that Kenneth D. Morrison asked some time ago on behalf of the Minnesota *Conservation Volunteer*: "If you were asked to select a 'conservation library,' restricted to five books, for the average layman interested in the conservation of natural resources, which five would you recommend?" Mr. Morrison published the results of his poll, in which 33 out of 47 who were offered the franchise "at random" actually voted, and has made available copies of a reprint of his eight-page summary and listings. It will be well worth a letter addressed to: Department of Conservation, 619 State Office Building, St. Paul 1, Minn. Mr. Teale himself has recently also compiled a book list—for *Audubon Magazine*—described as "The Great Companions of Nature Literature: A 100-Volume Nature Library" and made available at five cents a copy by the National Audubon Society, 1006 Fifth Avenue, New York. This list, too, is well worth having and will help temper the urgencies with which new books crowd the old ones off the reading table. "There's good 'structions in books," as one of Edward A. Preble's handy men once put it, decidedly so in the list Kenneth Morrison derived from his poll, and there is a great deal of charm in Edwin Way Teale's library. You can seek teachers in one list and companions in the other, with little risk of disappointment.

As for me, I have little disposition to undertake a listing of a hundred books of any kind, but I have been intrigued by Mr. Morrison's query. Perhaps I should hold my peace, for he offered me a franchise, and like lazy citizens in November I simply failed to vote. For his purposes, though, it was just as well that I did, for the list I had prepared would have made it impossible for him to select five, simply by counting votes. He received 22 votes for Ira N. Gabrielson's *Wildlife Conservation*, 10 votes for *Conservation in the United States* by A. F. Gustafson, C. H. Guise, W. J. Hamilton, Jr., and H. Ries (for both of which I intended at that time to vote), and 7 votes each for *Soil Conservation* by H. H. Bennett, *This Is Our Land* by E. G. Cheyney and T. S. Schantz-Hansen, and *Conservation of Our Natural Resources, based on Van Hise's "The Conservation of Natural Resources in the United States"* by Loomis Havemeyer, Gar A. Roush, Frederick H. Newell, Henry S. Graves, George S. Wehrwein, Paul G. Redington, and Elmer Higgins. My vote for this last work would have raised its tally to 8, and my vote for *Fading Trails: The Story of Endangered American Wildlife* by Daniel B. Beard, Frederick C. Lincoln, Victor H. Cahalane, Hartley H. T. Jackson, and Ben H. Thompson, edited by Charles Elliott, would have raised its total to a three-way tie for fourth place, and then there would have been no first five. The whole poll would have failed!

Now I have changed my mind anyhow. The list resulting from this poll seems altogether too heavy as a library for the "average layman" for which it was presumably prepared. So does the list I had in mind. Any one of the winning five might belong in such a library but probably *not* any two of them and surely not all five. I now have in mind, out of the many conservation volumes I have read in the past decade and a half, five books that would seem to me, when put together on a shelf, to make a pretty good "library" for a winter's serious but interesting reading. I propose them as a reading course for the stormy months from November through March. This self-educating course on conservation happens to include a major on wildlife, but that is because I believe the "average layman" is more particularly interested in wildlife than in any other one phase of conservation.

For November, I suggest *This Is Our World*, written and illustrated (with naive drawings) by Paul B. Sears and published in 1937 by the University of Oklahoma Press at $2.50. First of all, this book is easy to read. Its author was a university professor, but he knows how to relax in print. Then, too, it is general, and good in an introductory way for a thoughtful series of books on conservation. As I wrote when I first reviewed the book, "the title is the thesis in a most meaty nutshell, whether one reads it as *THIS Is Our World*, or as *This is OUR World*. Dr. Sears takes equal pains to demonstrate in words that are common to all of us the character of the environment in which we live . . . and also to plead as emphatically as a seer can for all of us . . . to realize that this environment is ours to ruin if we will but also to enjoy for generation after generation—again if we will." I think that this book will intrigue my "average layman's" interest and give him some pretty good ideas.

By December I shall expect him to be ready for a little bit heavier reading but still interested in general ideas and basic principles. My December assignment is *Natural Principles of Land Use* by Edward H. Graham, published in 1944 by Oxford University Press at $3.50. I have been rereading this book, and I am impressed anew with its value as a comprehensive treatise that discusses general principles yet keeps aware of the interesting particulars. As I wrote on this page last October (in 1944), "the writing is clear and alive, the book is effectively and abundantly illustrated, and the 29-page bibliography is unusually helpful" (although this bibliography really should have included *The Soils That Support Us* by Charles E. Kellogg, the best book on soils that I have read). Dr. Graham's book was too recent a publication to have general consideration by Kenneth Morrison's voters. If the poll were being taken now I believe that *Natural Principles of Land Use* would rank high.

My January selection is another volume that was not available last year—the University of North Carolina Press's recent $4 publication *Behold Our Green Mansions: A Book About American Forests* by Richard H. D. Boerker. I believe that few laymen think about conservation without imagining a woodland setting. So as my reading course progresses from broad ideas of conservation, through general principles, to practical application I would choose first of all this volume on forests. As Mr. Westwood observed in this magazine's recent review, this is "a readable book" and one "that will inform every American who realizes that it is his duty to know the fundamental importance of our forests and the problems they involve." It discusses not only forestry but recreation, and includes descriptions of "superlative" areas, primeval areas, wilderness areas, roadside areas, camp-site areas, residence areas, and outing areas. It deals with soil and water and wildlife conservation. It gives the lay reader an opportunity to study all of conservation from a single, definite point of view, the forester's, yet at the same time shows that conservation itself can never be successfully

restricted to any one resource.

It is one of the many virtues of Dr. Gabrielson's *Wildlife Conservation* (which The Macmillan Company published in 1941 at $3.50) that it too is, in its own words, "an effort to put into simple language the basic facts in this field and to emphasize that the various programs for the conservation of soil, water, forests and wildlife are so closely interwoven that each vitally affects one or more of the others." As I observed in 1941 in these pages, *Wildlife Conservation* is "written by one who by necessity is experienced in attending to interrelationships and in discovering the common grounds of conflicting interests" and thus very appropriately discusses "mainly the basic facts and principles of wildlife conservation and the interrelationships of many diverse factors." Yet the book is much more simply written than these descriptive sentences of mine, and it is interesting. It belongs on any current list of conservation books, and it is not at all surprising that its vote in the *Conservation Volunteer* poll was more than double that of its nearest competitor. It might well have been a unanimous selection. By the time my reader has finished February with this book he will no longer be an average layman.

Conservation reading, however, should be more than education, and so as March comes in (March the month of wildlife conferences and springtime discussions of conservation programs and policies) I am suggesting that my reader conclude his five-month course with a book which declares itself to have been written "to show how certain forms of wildlife have approached the brink of extinction and now stand ready to follow a fading trail down into the twilight." Of course it is *Fading Trails* (published in 1942 by The Macmillan Company at $3). I called this in my 1942 review "a case-history book of wildlife conservation"—just the sort of volume needed at the end of a course of study. "Certainly," I wrote then, "those who will read *Fading Trails* should have both a strong and well-informed determination to see these trails again so well-worn that they may be apparent to any Americans in the future who seek them out." It is the effect toward which all the other authors in this curriculum have also been writing but (as a good conclusion should be) *Fading Trails* is touched with emotion and, as reading matter, moves along with a rather exciting interest to the end.

My reader, I am sure, will find these books well worth $16.50 (in easy book-at-a-time, monthly payments), for I am confident they will prove to be not only good reading but also a good nucleus for a conservation library, a good investment. But how I pity the conservationist whose library is "restricted to five books!" Books for the conservation library are increasing in number.

Optical Instruments

Optical Instruments. By Earle B. Brown. Brooklyn, N. Y. 1945. Chemical Publishing Company. 567 pages. Illustrated. $10.00.

As in many other directions, World War II has resulted in a tremendous advance in the development of optical instruments. The need, therefore, has arisen for a book that will provide a reasonably thorough coverage of the general field as it exists today. Most existing volumes are restricted in their scope. This immediate volume by Mr. Brown is directed to those who use optical instruments as students, operators, teachers, engineers or repairmen. It is not intended as a manual of instruction for the use and care of any particular instrument, or for the optical or mechanical engineer.

Study German Methods

Since last June a dozen forest products experts have been in Germany gathering complete information on all phases of wood processing, conversion, modification and use developed by the Germans, according to an announcement by the U. S. Forest Service. Much of this information will be of value to United States industry, and preliminary reports indicate that, in some directions, it will be more valuable than originally anticipated. New and improved methods and techniques in producing wood sugar and its products, such as ethyl alcohol, feeding yeast and others, are expected to be revealed.

Living Memorials

From the offices of the American Commission for Living War Memorials comes a new booklet entitled "More About Memorials that Live." It is profusely illustrated and contains suggestions in the form of general plans on a variety of living and practical memorials. These range from community forests, camps and parks to stadiums. Headquarters of the Commission are at 30 East Broad Street, Columbus 15, Ohio.

Pollution Abatement

At its annual executive conference the New York Joint Legislative Committee on Interstate Cooperation adopted a resolution calling for "a complete program of pollution abatement in this state." It declared that solution of this problem is a major postwar responsibility, both from conservation and health standpoints. Expansion and amplification of state laws, along the lines of action in Pennsylvania, will be necessary. The Legislative Committee will join with other state agencies concerned in formulating a complete program. Insofar as the Hudson River and the waters around New York City are concerned, it is estimated that the pollution control job is about half done.

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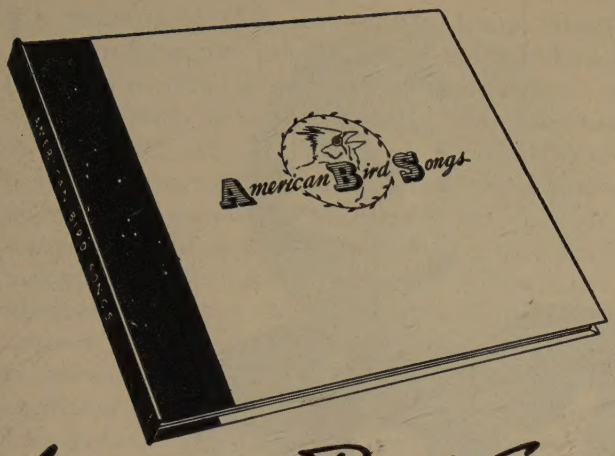

American Bird Songs

These Phonograph Bird Song Records are from the Laboratory of Ornithology, Cornell University. They were recorded in Native Wilds by the Albert R. Brand Bird Song Foundation.

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The bird's song had to be amplified several thousand times. That means that extraneous sounds, such as wind in trees, running water, airplanes, farm machinery, and notes of other birds were amplified too. For that reason many promising attempts at recording proved failures. The songs here recorded represent the best results of many efforts.

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2. Veery	2. Rose-breasted Grosbeak
3. Wood Thrush	3. Slate-colored Junco
4. Hermit Thrush	4. Yellow-bellied Sapsucker
5. White-throated Sparrow	5. Alder Flycatcher
6. Whip-poor-will	6. Olive-sided Flycatcher

Birds of Fields and Prairies

No. 4 A	*No. 4 B*
1. Bobolink	1. Prairie Horned Lark
2. Meadowlark	2. Savannah Sparrow
3. Western Meadowlark	3. Lark Sparrow
4. Vesper Sparrow	4. Killdeer
5. Field Sparrow	5. Spotted Sandpiper
6. Red-winged Blackbird	6. Burrowing Owl

Birds of Northern Gardens and Shade Trees

No. 2 A	*No. 2 B*
1. Song Sparrow	1. Chickadee
2. Robin	2. Wood Pewee
3. Catbird	3. Chipping Sparrow
4. Baltimore Oriole	4. Red-eyed Vireo
5. Yellow Warbler	5. Yellow-throated Vireo
6. Flicker	6. Warbling Vireo

North American Game Birds

No. 5 A	*No. 5 B*
1. Ruffed Grouse	1. Gambel's Quail
2. Bob-white	2. California Quail
3. Wild Turkey	3. White-winged Dove
4. Dusky Grouse	4. Woodcock
5. Prairie Chicken	5. Canada Geese
6. Chachalaca	6. Mallard Duck

Birds of Southern Woods and Gardens

No. 3 A	*No. 3 B*
1. Indigo Bunting	1. Mockingbird
2. Pine-woods Sparrow	2. Brown Thrasher
3. Pine Warbler	3. Cardinal
4. Orchard Oriole	4. Summer Tanager
5. Yellow-breasted Chat	5. Chuck-will's-widow
6. Carolina Wren	6. Barred Owl

Birds of Western North America

No. 6 A	*No. 6 B*
1. Wren Tit	1. Lazuli Bunting
2. California Thrasher	2. Blue Grosbeak
3. Nuttall's Sparrow	3. California Shrike
4. Fox Sparrow	4. California Purple Finch
5. Western Tanager	5. Plumbeous Vireo
6. Black-headed Grosbeak	6. California Woodpecker

★

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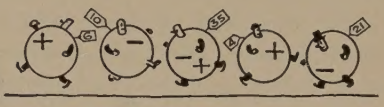
Contents Noted

IN THE August, 1945, issue of *The Lamp,* attractive and informative publication of the Standard Oil Company of New Jersey, appears a provocative article by Hermann B. Deutsch entitled "Wildlife Thrives in Oil Fields." The inspiration of the article appears to be alarm voiced for Florida wildlife because of the discovery of possibly commercially valuable oil resources in the Everglades. Mr. Deutsch points out that a variety of wild bird life prospers in Louisiana, at McIlhenny's Avery Island and on Federal refuge areas in close proximity to oil fields. The discussion is interesting, and will certainly be productive of argument among ornithologists and conservationists. Unquestionably wildlife has gotten along with oil development in Louisiana reasonably well, thus far. However, in our opinion, the Florida oil discoveries constitute more of a threat against the creation of the long-projected Everglades National Park than they do against wildlife. How the latter will fare, if oil *is* exploited, will depend upon how well regulated oil production may be, and what provisions are made for administration of wildlife resources. We do not think that it is merely a case of letting things work themselves out, as, one gathers, is Mr. Deutsch's thesis. There must be both policy and program.

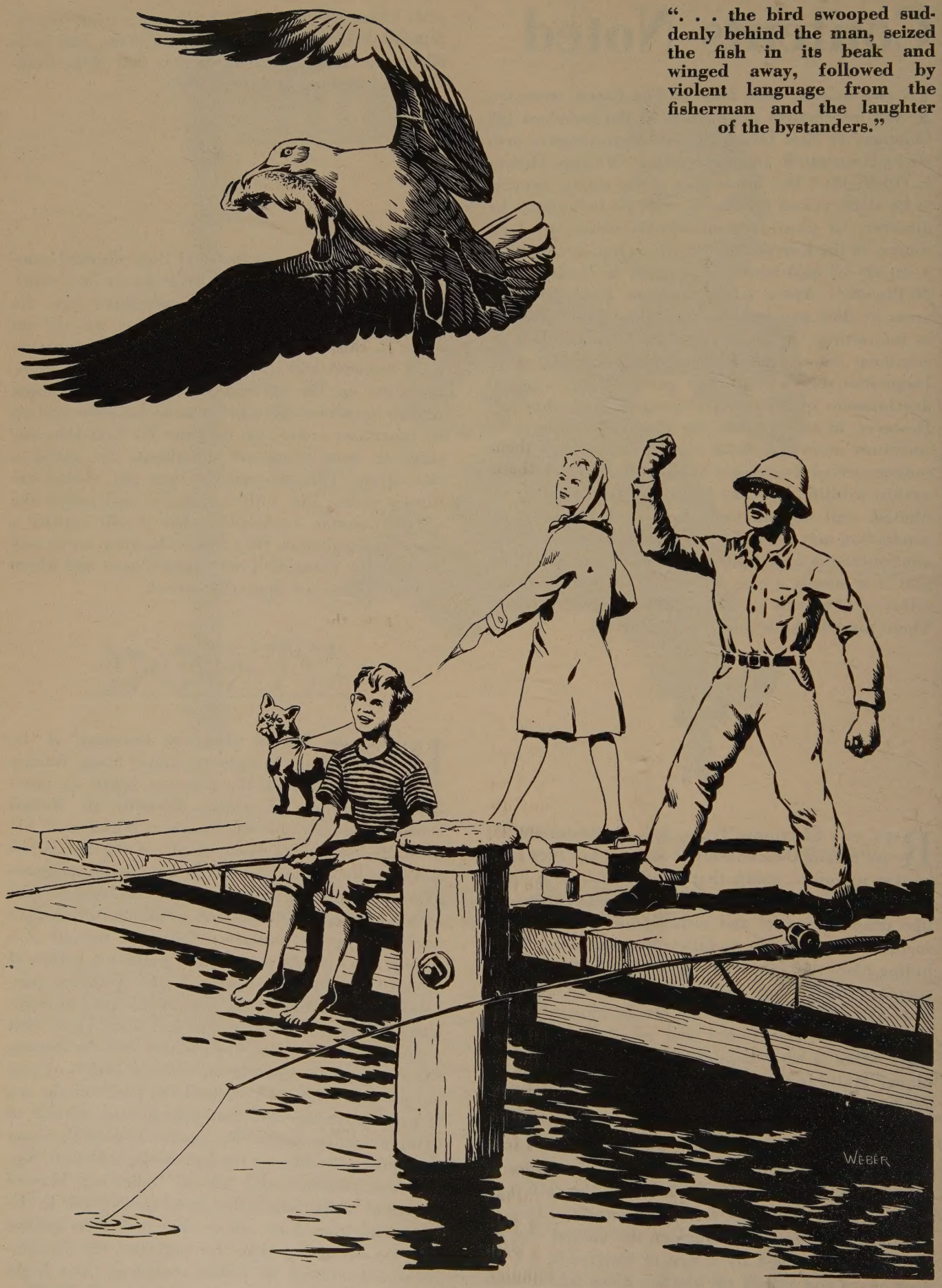
RATS, says Electronic Traps, Inc., Rochester, N. Y., are among the cleverest of animals but they have certain ingrained habits that are their undoing. Trap inventors spent time spying on rats; found they dislike deadend streets and walking on an unfamiliar surface. Also they like to follow the same route from hiding place to food and water, and back. So the trap company made a trap with no floor, and open at both ends like a tunnel; a trap that can be plugged into a convenient electric socket and set down on a rat route. Here is what happens: The rat goes into the tunnel. Halfway through it breaks an unseen electric eye beam. Doors at either end close, and a small door at the side opens. Seeing possibility of escape, the rat dashes through this door into a small compartment from which a ramp runs up into an electrocution chamber. A slight electric shock tickles the rat's feet, so it starts up the ramp, at which moment a door at the top opens. Into the chamber the animal rushes, there to be clutched by a vise of electrodes, a trap door opens and a dead rat tumbles down into a waiting basket. All this takes an average of three minutes, after which the trap resets itself and is ready for rat number two, and so on. We are serious, and so is Electronic Traps, Inc., which says that Rube Goldberg had nothing to do with this.

ATOMS, neutrons, isotopes and their assorted cousins, brothers and sisters have got us in a whirl, we confess, although we *can* understand how the electronic rat trap works. We suspect we are not alone in this. And to further confuse us comes the plant scientist with "tagged atoms." Scientists know they are on the threshhold of discoveries about growth hormones and want to make the plant give up its innermost secrets. So they use the cyclotron machine to make atoms of phosphorus, for example, radioactive. This substance is then put around the plant's roots, and with a delicate tool called the Geiger Counter, so sensitive that it will register a single charged atom, they follow the atom on its way through the plant, find out where it goes and where it stops. Thus are mysteries solved.



DURING the Sunday afternoon broadcast of the Philharmonic Symphony, United States Rubber Company, sponsors of the program, brings an intermission interlude of science. Recently Dr. Robert Cushman Murphy of the American Museum of Natural History talked fascinatingly of the unfamiliar penguins known as gentoos. In his closing sentences he told of coming upon a gentoo "graveyard," describing it so beautifully that we are constrained to quote it here for posterity: "Near the summit of a coastal hill I came upon a lonely pond in a hollow of ice-cracked stones. Several sick and drooping penguins were standing at the edge of this pool of snow-water, which was ten or twelve feet deep. Then, with a tingling of my spine, I perceived that the bottom was strewn, layer upon layer, with the bodies of gentoo penguins that had outlived the perils of the sea to accomplish the rare feat among wild animals of dying a natural death. By hundreds, possibly thousands, they lay all over the bed of the cold tarn, flippers outstretched and breasts reflecting blurred gleams of white. Safe at last from sea-leopards in the ocean and from skuas ashore, they took their endless rest; for decades, perhaps for centuries, the slumberers would undergo no bodily change in their frigid tomb."

R. W. W.



". . . the bird swooped suddenly behind the man, seized the fish in its beak and winged away, followed by violent language from the fisherman and the laughter of the bystanders."

Gulls of the Harbor

By WALTER W. HOFFMANN

Illustrated by Walter A. Weber

WHEN I was a boy of twelve I was fishing with a companion from a pier jutting into the Hudson below Riverside Drive Park. Nearby was a man who had caught a tomcod and laid the fish beside him on the pier. Overhead a herring gull flew lazily. Then, to my amazed delight, the bird swooped suddenly behind the man, seized the fish in its beak and winged away, followed by violent language from the fisherman and the laughter of the bystanders. I have always cherished the amusing memory of this little incident, often recalling it during years as a commuter, traveling over the Hudson from the Jersey shore to lower Manhattan each working day, and returning home again on most evenings by the ferryboat. Between the low-lying western bank of the river, with its railroad yards and warehouses, and the New York side, with its dingy waterfront and its tall buildings just beyond, is the realm of the gulls. Watching them flying, soaring, or bobbing on the waves gives a variety in interest to these many trips across the river, crossings that would otherwise offer little beyond a tedious repetition.

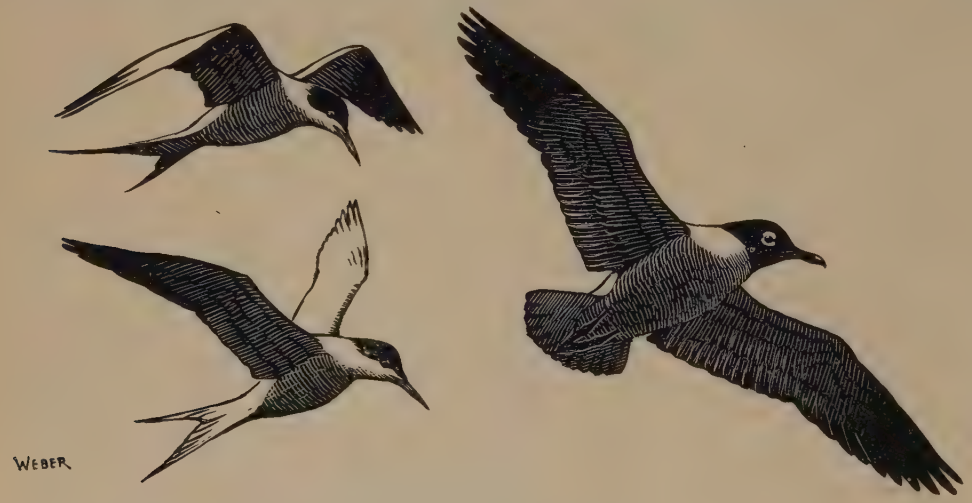
As the ferry moves out of its slip in the morning there will often be a gull standing on one of the piles at the end of the slip, regarding the advancing boat out of cold, pale yellow eyes, and turning its snowy head from right to left with an air of mounting disapproval at the nearness of human beings. Sometimes the feathers underneath the bright yellow beak with its little red spot at the angle will move slightly as though the bird were muttering to itself. Slowly it stretches its blue-gray wings, which are the color of its back, although these are white-tipped and decorated near the ends with a contrasting bar of black. Then the bird launches forth to wing in easy flight across the water. This is a herring gull at least three or four years old. No ferry passenger who does not habitually remain in the stuffy cabin, or keep his face buried in a newspaper, can have failed to notice the numbers of gulls of dusky plumage flying about. These are the youngsters, of one and two years, and only a little curiosity and an observing eye will serve to distinguish them from gulls in their third year and the older ones.

Herring gulls in their primal year have tails and wings dark brown and black near the wing-tips, while the rest of the body is a dark gray plentifully marked with brown on the back and streaks of dusky white on head and neck, while the breast and underparts are simply smoky gray. The beak is also dark, and the eyes are a soft brown. In its second year the herring gull takes on a more adult plumage, although still barred with brown on the grayish back and streaked with smoky gray on head and neck, breast and belly. About the only way to tell a gull of three years from its elders is by the slightly darker beak and the probable absence of the red spot on the lower mandible.

Everything that can be seen from the ferry except the sky and the gulls has changed tremendously since the days when Indian dugouts were the only craft in which men rode the waves about Manhattan Island or in the bay below. The water has certainly changed from its clean naturalness to a state of sad pollution, greasy with the oil slicks and fouled by sewage, floating rubbish and miscellaneous garbage. Only civilized

man could show so little decent regard for one of the most beautiful streams and spacious harbors in the world. Yet it is this very pollution that has given the herring gull the stern protection of the law, and has, likewise, given this bird the reputation of being a scavenger and an eater of garbage. To be sure, it is, for such food is easy to pick up and hungry gulls are not fussy about their food. But for the sake of truth and in justice to the gull it should be noted that if it has the choice, it will always prefer fresh fish to carrion, and fresh clams or mussels to garbage. This has been demonstrated through experiment by professional ornithologists.

It is a pleasant sight on a sunny day to see a dozen or more gulls bobbing on the waves of the river. At a distance they look a little like ducks on the water, except that they ride so high, like Chinese junks. Only their bellies are lightly in the water and this is because the air held in the tight mass of belly feathers and in their hollow bones gives them a remarkable buoyancy. They seldom swim about, merely paddling with their webbed feet to keep their place against the tide. Even in winter, when the ferry crunches through the drifting ice floes and the thermometer is near to zero, gulls can still be seen bravely bobbing about in stretches of open water between the floating ice.



"For a few days, usually in the latter days of April, the harbor scene is enlivened by the presence of laughing gulls, common terns and least terns, on their spring migrations."

But it is in flight that the herring gull displays its airy artistry of motion. In perfect adjustment to currents of the air and in precision of maneuver the herring gull is unsurpassed by hawk or frigate bird. Watching the flight of the gulls is something of which I could never tire. Look intently, and you will see that the slow flapping of the wings is not just moving them up and down. No bird could fly by a mere raising and lowering of the wings, any more than a man could swim simply by moving his arms up and down. The wings are brought forward and then thrust downward *and* backward in one movement, and then brought around and upward again, so that the tips of the wings make a series of circles in the air like lateral propellers. The downward motion is to maintain the bird's elevation while the backward thrust drives the gull forward. The same may be said, of course, of the flight of all birds, regardless of varied speed of wing strokes or dimensions of wings in different species.

This flapping motion may be seen when the gull starts its flight, or chiefly on days of little wind when the birds are flying close to the surface of the water. As the gull rises, its feet remain hanging for a few seconds and then are stretched out close to the body underneath the tail like retractable landing gear. The feet are dropped again just before the bird alights, or sometimes in a sharp turn so that the gull can pivot the better in the air. Like all the long-winged fliers, the gull cannot rise in the air without several preliminary strokes of the wings, and the less wind the more flapping is necessary. It is in riding the streams of the wind, however, that the flight of the herring gulls achieves perfection. On outstretched wings, with only an occasional adjusting motion, they are able to sail incredible distances in the very face of the wind. And sometimes, far aloft, a flock of gulls will circle on clear late afternoons in airy arabesques of flight, no doubt for the sheer sport of riding the wind in a sky above all natural or man-raised obstacles. The loops and intersecting circles of the soaring gulls against the blue and white of heaven are as a silent song to freedom and the joy of living.

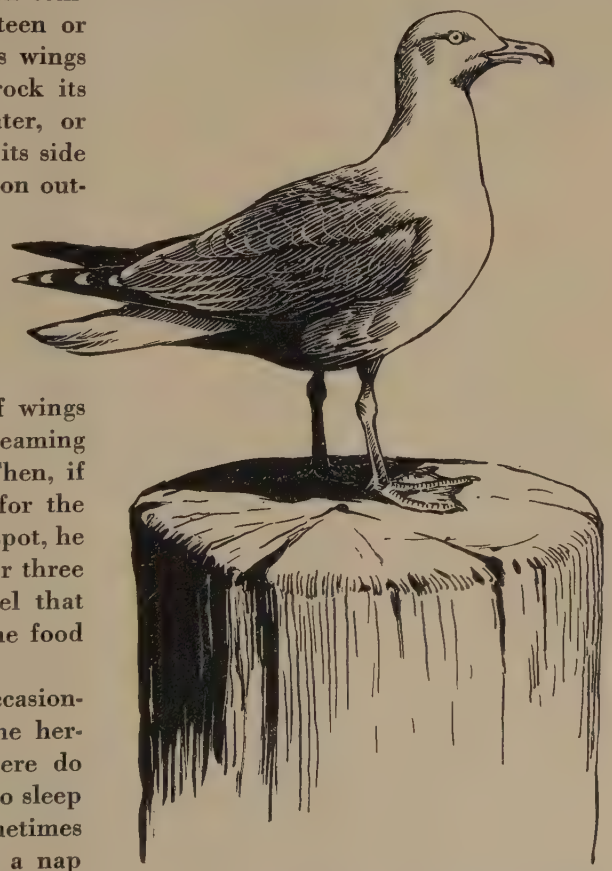
Sometimes some charitable soul will toss scraps of bread or other food from the ferry for the gulls, and in a short time a score or more of them will be following the boat across the river. Except when descending for some morsel, they will glide along without apparent effort on almost motionless wings on the current of air from the stern of the boat. For, as the ferry moves forward, the air currents parted at the bow come together again and move upward at the stern. If the incidence of the wind is at an angle to the boat, against the starboard side for instance, the gulls will be seen soaring to the port side of the stern; and if the wind should be against the port side, the gulls will ride the current to starboard. The birds

"It is a pleasant sight on a sunny day to see gulls bobbing on the waves of the river."

fly on these occasions with wings and bodies slightly tilted forward, so that, if there were no air current, they would soon reach the water, but the upward movement of the air behind the boat is enough to keep them at a fairly constant elevation. On the other hand, if they flew with bodies level, the same current would carry them upward and over the boat. Neat, indeed, is their adjustment to the motion of the air.

If a gull descends for food from any considerable height, it will come down on banked wings in a steep and swift glide. But when coming down from only fifteen or thirty feet, it will tip its wings from side to side and rock its way quickly to the water, or else it will turn over on its side and fall through the air on outstretched wings, righting itself just before touching the water. When two or more of the birds reach the same morsel there will be a brief flurry of wings and a high mewing screaming of eagerness or anger. Then, if the morsel is too large for the victor to swallow on the spot, he will be pursued by two or three others who evidently feel that hope exists so long as the food is still in sight.

Two questions are occasionally asked: Where do the herring gulls sleep and where do they nest? They appear to sleep remarkably little. Sometimes they can be seen taking a nap during the day atop some pier shed, but mostly they rest on the waters of the lower bay, or even of the Hudson itself. I have seen them on the water late at night in the glow of a ferry's lights or flying up from the water to escape the advancing boat. It cannot be a restful way of spending the night. Contrary to opinions or guesses I have heard, the gulls do not breed in the vicinity of New York. Their breeding grounds are on the coast of Maine and northward and westward to Labrador and into the Arctic. The fact that herring gulls are to be seen about the harbor all summer has no doubt led to the opinion that their nests must be nearby. But the gulls that remain when the rest migrate to the breeding grounds are the young ones, of one and two years, who are not mature enough to breed, and adults who are either sterile or barren, or whose advanced years have left them without interest in the romantic life.



". . . there will often be a gull standing on one of the piles at the end of the slip . . ."

Early in March, depending on the weather, the herring gulls leave for their breeding colonies, and from then to late September the number of gulls is considerably less about the harbor than in the autumn and winter months. They gather in thousands on Great Duck Island and Little Duck Island, on No-Man's Land in Penobscot Bay, on rocks off the Cape Breton Peninsula and on the bleak coast of Labrador. Their nests are shallow bowls, loosely-built of bits of wood, beach grass, seaweed, moss and feathers, and therein the female—who looks exactly like the male—usually lays three eggs. Sets of only two eggs are uncommon, while nests with only one or with four are

rare. Incubation takes from twenty-four to twenty-eight days, and hatching goes on from mid-June to the end of July, or even into the first days of August. Within a day the chicks can run about readily, and they begin to fly in thirty to forty days. In the first two weeks of September the southward migration has begun, from Maine, and even earlier from the breeding grounds farther north. By the middle of the month the adult birds have gone, leaving the youngsters to shift for themselves and to come south later without parental guidance.

That the young gulls are able to find their way south by themselves is a phenomenon that leads me to think that the herring gulls, like many other creatures, have a tribal mentality rather than an individual one; that mind belongs to the species, and that the individual partakes of it. That is to say, the gull's mentality is not individualized, like the human mind, although the gull is certainly an intelligent bird and one gull may have more ingenuity than another in meeting the problems of life.

For a few days, usually in the latter days of April, the harbor scene is enlivened by the presence of laughing gulls, common terns and least terns, on their spring migrations. They come up the coast, fly about the bay and the river for a few days and depart for their breeding grounds on the coast or to the north. It is pleasant to see the strong but light-winged flight of the laughing gulls, and to hear their husky, high-pitched "Ha-ha, ha-ha!", drawn out on the final syllable. Gull-like, they fly about singly or in loose flocks at good distances from each other. Their black-tipped wings and black heads stand out in bold contrast against the slaty-gray and white of their bodies, and there is a joyous buoyancy in their rapid flight and intermittent soarings even more than with the larger herring gulls. And then there are the common terns, almost as large as the laughing gulls; and the least terns, no bigger than robins, flickering over the water in flocks like swallows, uttering their high, soft piping cries.

You can tell the difference between the laughing gulls and the black-capped common terns from their manner of flight and feeding. Gulls flap their wings and often soar. Terns have a flickering flight like that of swallows. Gulls carry their heads and beaks straight in line with their bodies, while terns have their beaks pointing downwards at an angle. In feeding, gulls swoop down and often pick their food from the water on the wing; or if they dive, they never plunge wholly into the water. But the terns hover and dive straight down, and often completely into the water after their prey. I have seen least terns flying to and fro over a spot, some ten or fifteen feet above the water, only a few yards from the beach on Cape Cod, early on summer mornings, while laughing gulls flew over the dark pines, one by one. Suddenly a tern would dive in a little sparkling splash, emerge almost as though it were flying right out of the water, and swallow its food on the wing.

Observation will show differences in the plumage of laughing gulls and common terns, and again between the latter and the least terns. The whole head of the laughing gull is of a slaty-black, with a white spot above and below each red-circled, reddish-brown eye. While the back is of a slate gray, and the outer primary wing feathers the same color as the head, the rest of the bird is white, save for the reddish beak and legs and feet. The common tern wears a greenish-black cap above the level of the eyes and the wings are grayish-dark of a silvery tinge and the back a grayish-blue. Neck and belly, tail and rump are white, and the feet are bright red and the beak vermilion shading to black tipped with yellow.

The least tern resembles the common tern in various respects, except in size. The greenish-black crown bears a crescent in back of the head reaching above the eyes to the beak; while there is a dark line from behind the eyes to the bill. The wings have the gray-blue shade of the back, but darker, while the outer primaries are black with white spaces most noticeable when the bird is in flight. The beak is yellow tipped with black, the feet orange, and the eyes are brown.

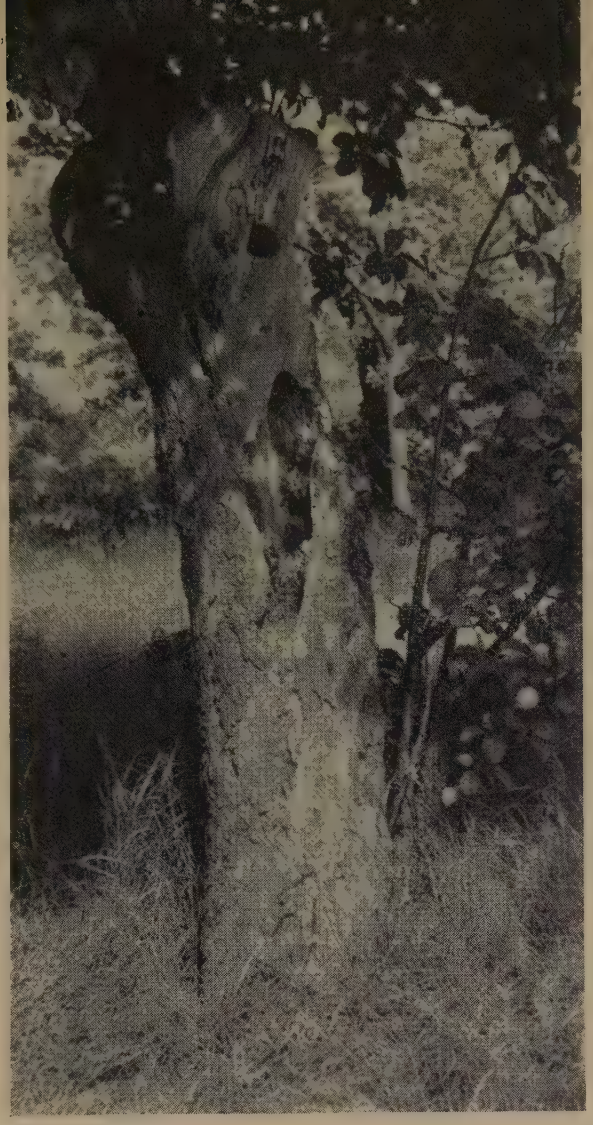
Again for a few days, as autumn is coming on in September, the least and the common terns and the laughing gulls will visit the lower Hudson and the bay on their migrations to the south—and south for these birds means anywhere from South Carolina and Florida to Brazil. More silent now, and less vivacious, but still bringing with them into the harbor, with its commerce and smoke and rubbish, a sense of the open sea and the surf-girt rocks and the long lonely beaches where the winds of autumn will be withering the thin grass.

We came close to losing altogether these fleeting glimpses of wild beauty in spring and autumn, for only the enactment and enforcement of Federal laws for the protection of migratory birds have saved these sea birds from extinction. Plume hunters had haunted the breeding grounds of the laughing gulls and the terns, all along the Atlantic coast from the Carolinas to Maine, and slaughtered the nesting birds by the thousands. Without the protection of law these gulls and terns, and other species of sandpipers and plovers, would by now have been wiped out, poor little sacrifices to imbecile fashion. We would have gained nothing thereby, and we would have been poorer in one of those things that make life worth living.

Seagulls

By JANET MOORE

They sweep the sky with crescent blades,
Which slash the fabric of the air
As breaking wave cleaves ocean's calm,
And grave a lyric etching where
They swirl and drift through sunlit height,
Wed to the wind in silver flight.



This wild bee tree is a bee-tree without honey, but here the *Halictus* bees made their tunnels.

World of a Wild Bee

The third of three articles from his "Insect Garden"

By EDWIN WAY TEALE

IT WAS ten o'clock in the morning on the 140th day of the year. The late-May sunshine flooded down from a blue and cloudless sky. As I leaned forward, peering into the hollow of a decaying treetrunk, petals of apple-blossoms descended in little swirling flurries around me. They bumped noiselessly along the branches, drifted down the slope, caught on the turf and shone there, white as snowflakes against the green of the grass-tangles. The breeze that swept them down the hillside had a touch of coolness, reminiscent of the previous night's rain. The sun was a summer sun; but the breeze was the breeze of spring.

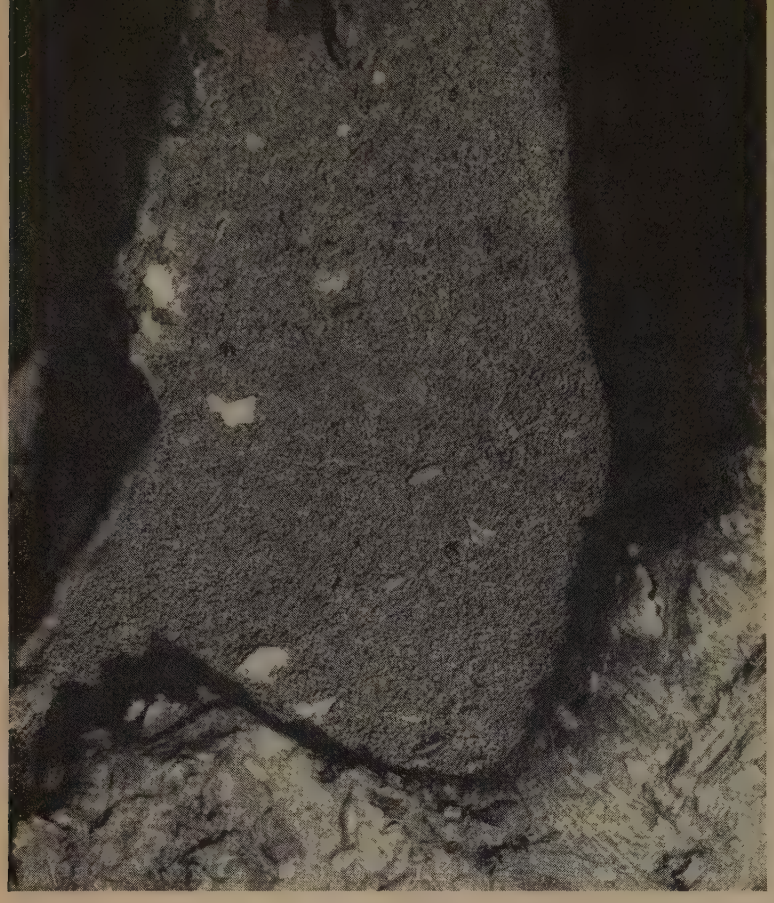
For half a hundred years and more, the old apple trees of that orchard hillside had responded, with bud and blossom, to each new spring. In yearly succession, new installments of robins and blackbirds had alighted on their branches. New allotments of wild bees and butterflies had sunned themselves on the same bark where other generations had basked before them. Each evening, from the marshy lowland at the foot of the hill, hylas of another year lifted their voices, and that quavering, lonely, age-old call that is the very vocal symbol of the spring carried up the slope of my Insect Garden. Everywhere around the old tree before which I stood, May was presenting the cast of a fresh summer's drama.

Even within the hollow of the treetrunk, where heartwood was moldering into chocolate-colored dust, a whole population of small and humble creatures had responded to the warmth of spring. Hidden amid the ruins of this cavern were pillbugs, centipedes, wireworms and other minutiae of the garden. And, in the sunshine of its exterior, wasps, flies and wild bees alighted and took off and alighted again. It was, indeed, a busy community of insects.

As I peered into this small world of moldering wood, there came to mind an old volume with yellowing pages and green covers. In 1937, when *Grassroot Jungles* first appeared, Dr. Leland O. Howard, for many years head of the U. S. Bureau of Entomology, had written me about a charming volume he had received as a present when he was a boy of fourteen. It had stirred his initial interest in the insects. Written in French about the time of the American Civil War, the book was called *The Population of an Old Pear Tree.* Its author was E. Van Bruyssel. For several years, I tried without success to find an English translation. Finally, John Sherman, a friend of mine who has spent a lifetime acquiring a knowledge of the probable whereabouts of insect books, discovered one in Sydney, Australia.

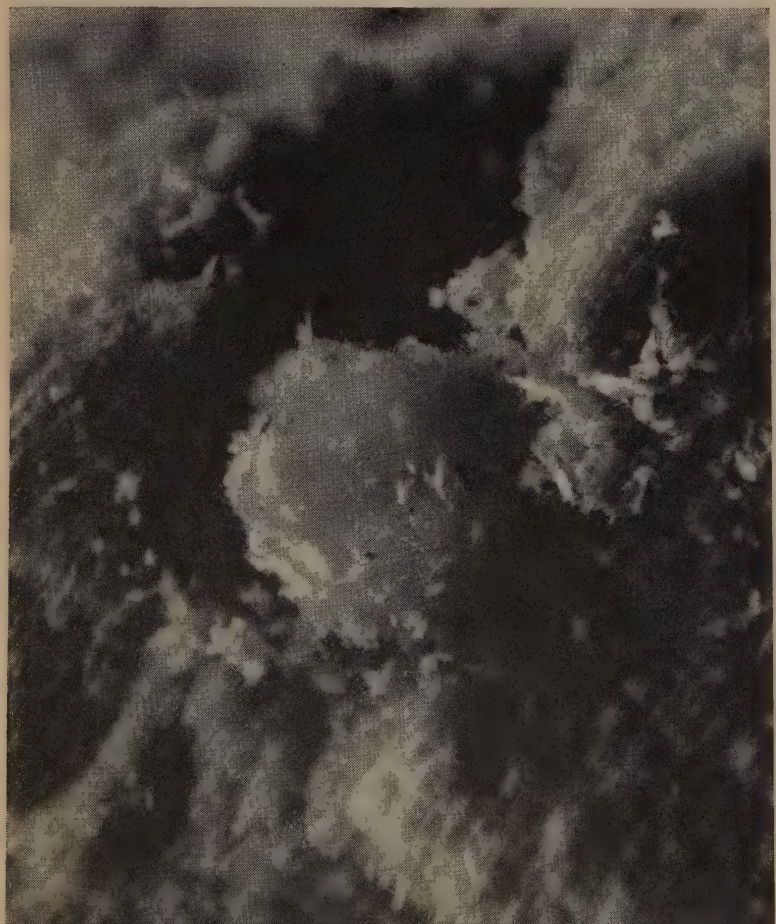
In due time, the book arrived. Its green cover was beginning to split at the hinges, and its pages—which had received their ink three-quarters of a century before—were stained and yellow. But the type was legible and the woodcuts retained all their original imaginative charm. On a summer's day, the author related, he dropped asleep in the shade of an old pear tree and there, in his dreams, explored, with the aid of microscopic vision, the bizarre world of its insect inhabitants. It was Van Bruyssel's explorations among the solitary wild bees of his pear tree that brought the book to mind as I peered, that day, into the hollow of my treetrunk.

For, there, small wild bees—their bodies glinting metallic green and their wings breaking into rainbow colors, like the film of a soap-bubble, when they shifted position in the sun—were alighting and taking off. They never flew in a straight line to the cavern like homing honeybees. Outside, they always approached with loops and curlicues. They zig-



A closeup view of the soft, decayed material that had sifted to the bottom of the cavern in the old apple tree, and which provided the wild bees with their homesite. Here were enacted the insect dramas.

One of the pollen pills desposited in the burrows in the apple tree. The larva hatches from the egg, which is laid on the pollen-mass, and then devours the food that has been stored up for it in this way.

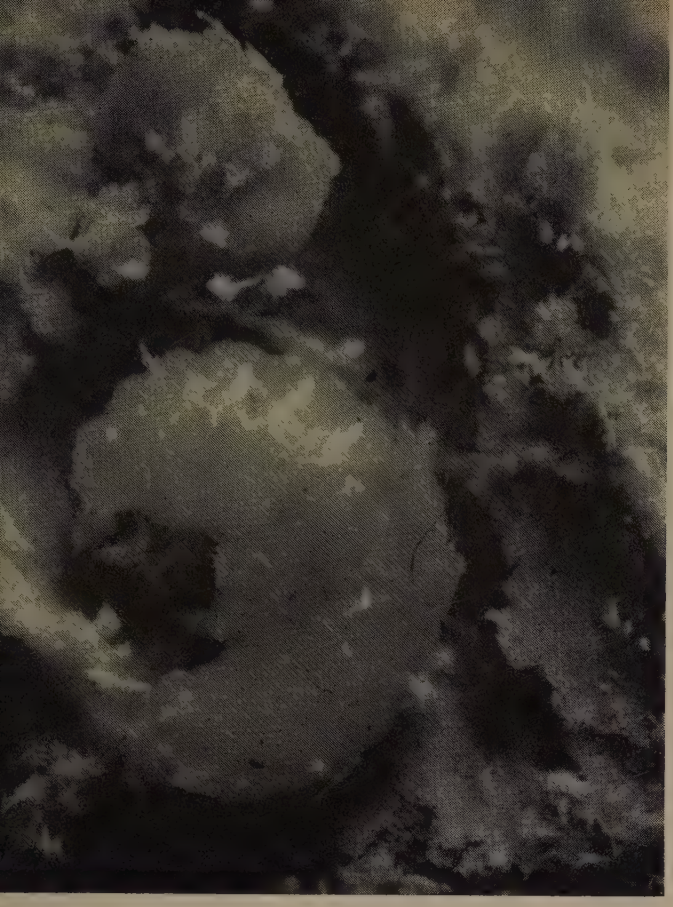


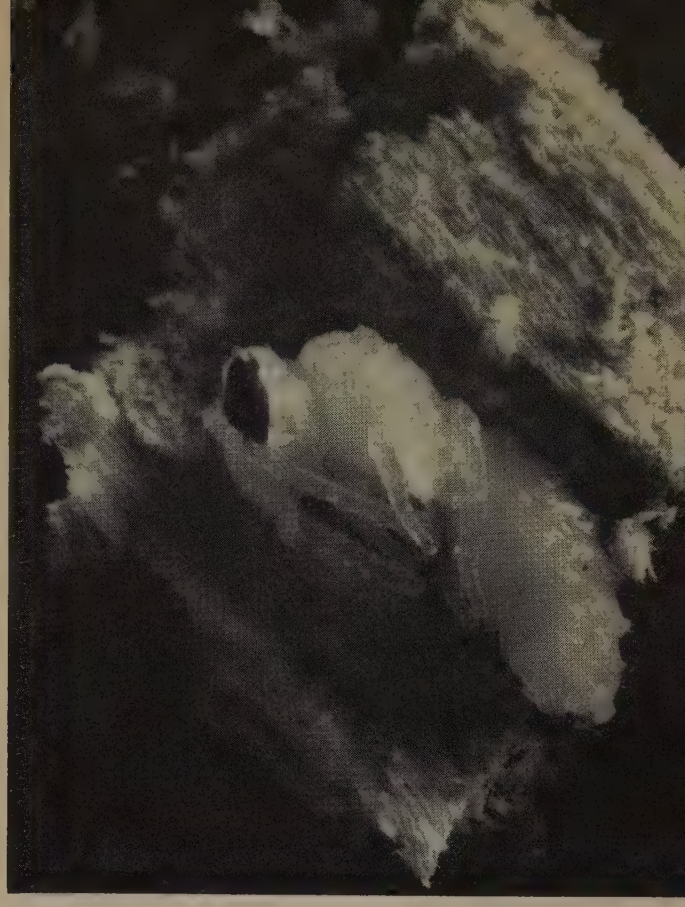
zagged from side to side before the opening. They whirled about, writing their hieroglyphics—a kind of insect shorthand filled with loops and hooks—on the air. Then they settled down and I could see their hind legs and the undersides of their bodies were thickly stuccoed with golden pollen. Oftentimes, when a bee settled down on the gray bark, or on the chocolate-brown mass of the decayed wood, and then took off again, it left behind a tiny smudge of yellow.

In small, rounded pellets, the pollen of the apple-blossoms was being stored at the bottom of tunnels excavated in the soft material of the cavern. Eggs, laid on these pellets, would hatch into larvae. Nourished by the pollen, the larvae would increase in size and eventually transform into the adult bees of another generation. The cavern was the site of a bee colony; but it was a colony without a queen. The tree was a bee-tree; but it was a bee-tree without honey.

The wild insects there were storing up no food except pollen for their offspring. And each female was gathering this golden dust and laying her eggs in the manner of a solitary insect. Yet, these bees—members of the *Halictidae*—belong to a family that represents one of the great initial steps in the direction of community life among the insects. In some species of *Halictus* bees, two females may use the same tunnel. But each deposits her own pollen and her own eggs in her own branching chambers off the main corridor. Sometimes they go even further in their partnership. While one is away, the other guards the entrance of the tunnel, remaining just below the surface and blocking it with her head. Compared to the vast waxen cities of the honeybee—with their intricate, instinctive laws—this simple form of cooperation among the primitive *Halictidae* is as rudimentary as is picture-writing compared to the product of the linotype. But it marks an epoch in the advance of the social instinct. And for me, in consequence, the green-tinted members of this family, that darted about in the sunshine around me, had particular interest.

Most of the pollen-laden bees were alighting on the brown "sawdust." At its surface, the dry material was so light it swirled in tiny dust-devils when struck by even such minute air-currents as those formed by the wings of the alighting,





three-eighth-inch-long insects. In a space less than a foot square, I counted eighteen holes. Each was about a quarter of an inch in diameter. Into these openings, the alighting bees pushed their way. Later, they would reappear with only a fine line of yellow running down their hind legs, the last remains of the pollen. When they took off, the fine particles of the moldered heartwood swirled and scattered beneath their wings until they were fully an inch in the air.

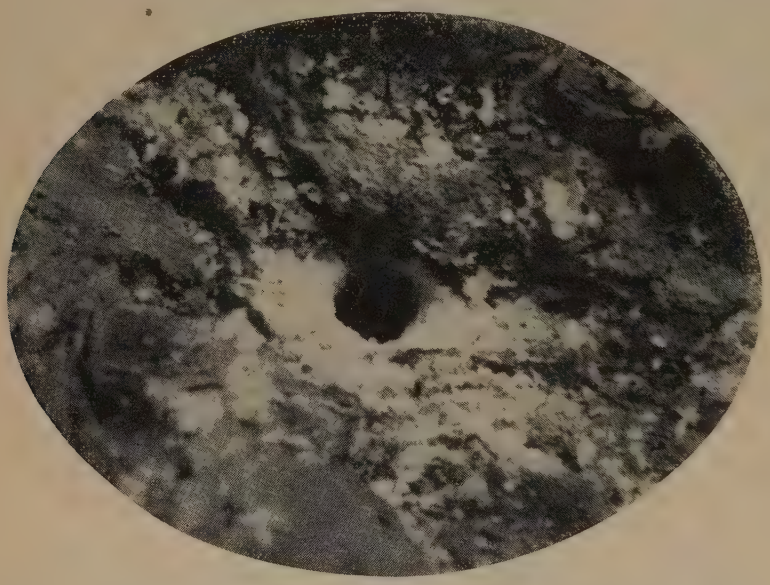
Other bees, without pollen, were digging into the brown material. As though swimming breast-stroke, they worked their way deeper into the pumice-like mass. Sometimes, a bee would begin digging and gradually descend at a steeper and steeper angle until it was progressing downward in a half-circle and was on its back when it disappeared. Others kept turning as they dug, so they entered the material like corkscrews. After a bee was out of sight, there sometimes would be no clear-cut hole visible at the surface. And, here and there as I watched, the brown "sawdust" would begin to heave as though a minute mole were at work beneath the surface. A few moments later, a buried bee would push its way upward and take wing.

Even while I was watching, an avalanche of disintegrated wood, dislodged from the decaying galleries above, slid down the inner slope of the cavern. The landslide erased half a dozen of the small openings. Each previous morning, I had found the holes of the night before covered over with similar debris. Like detritus from eroding cliffs, the brown powder slides down and out on the little plain below. The

At the left, above, is the larva beside the partially-consumed mass of pollen in the tunnel. Above is a later stage when the larva is transformed, within its burrow, into a "callow" or nymph. The next step is its emergence as the winged and full-grown adult bee with its metallic green body, as is seen below.

bees, after spending the night in their tunnels, emerged without difficulty by pushing their way up through this light coverlet.

It was usually nine o'clock, I noticed, before many of these wild bees became active. Until the mercury rose well above sixty degrees F., they remained in their tunnels. And there is a lag in the rise and fall of the temperature within the "sawdust" mass. For instance, at nine o'clock one morning, when I thrust a thermometer into the material to the depth of three inches, I found the reading was fifty-six degrees while the air outside was sixty-one degrees. When I made the same test at nine o'clock that evening, the outside temperature had dropped to fifty-seven degrees. But the reading within the mass was sixty-two degrees. Thus, the warmth within the material is either greater or less according to whether the mercury is falling or raising. In the morning hours, the small bodies of the bees, buried below the surface, are slow in warming up.



The entrance of one of the tunnels, which was made, not in the decayed material at the bottom of the cavern but in the soft, spongy wood of the upper trunk. Such holes were about a quarter of an inch in diameter and extended into the wood for something like three-quarters of an inch, then turned and ran parallel to the surface for an inch and one-half or so.

While I was leaning close to the cavern to see one laden bee alighting on the wood particles, the insect suddenly disappeared in a smother of flying fragments. A gust of wind, swirling around me, had entered the cavern. In whirling cross-currents, within the hollow, it swept the light and powdery surface material before it. In the space of a breath, almost every entrance-hole in the cavern was obliterated. A tornado, in miniature form, had swept across the brown surface of the little plain. The bee I had seen disappear struggled to excavate its way to the surface. At that moment, another bee, which had been tossed and tumbled by the swirling air-currents, dropped down to a landing just above the spot. The heavings of the material, as the buried bee worked upward, upset the newcomer and it took wing again. Tornadoes and earthquakes, in wild-bee size, had been its lot in quick succession.

Not all the pollen-laden insects descended to the bottom of the cavern. Some disappeared into holes in the more solid wood above. For several feet, in the soft decaying wood of the upper sections, the insects had mined out their little tunnels. Pure white, powdery material, the product of the jaws of the wild bees, extended outward from the entrances of such burrows. Near one hole, more than half a teaspoonful of fine wood-material had collected in a small hollow—fragile sawdust from the little mandible-mills of the insects.

Protruding from a burrow that had been just started was the tip of the tail of one bee. I touched it with a grassblade. The insect hastily backed out and darted away into the air. The same blade of grass, thrust into completed tunnels, revealed that they penetrated straight into the wood for about three-quarters of an inch and then turned and ran parallel to the surface for an inch and a half or so. With a jackknife, I tried the hardness of the wood. Softened by the night's rain, it had about the consistency of store cheese. With the steady pressure of one forefinger on the knife, I could push the full length of the blade into the spongy wood.

As I was withdrawing the knife, a diversion occurred. In running down the tree near the holes made by the *Halictus* bees, a dark-gray jumping spider came upon a tent-caterpillar resting on the bark. It stopped, approached cautiously, reached out an exploratory foreleg and touched the hairs of the larva. The caterpillar reared the forepart of its body into the air and swung it like an elephant's trunk from side to side. The spider scuttled backward and hid beneath a bit of loose bark. A minute went by and the spider appeared again, probing with outstretched leg. Again the caterpillar reared upward and for a second time the spider retreated hastily. For several minutes, this curious encounter on the bark continued. Then a pollen-laden bee settled down directly between the spider and the caterpillar. This proved too much for the spider. It retreated around the tree-trunk and was seen no more. (Continued on page 494)

Menomin, Nature's Cereal

Photographs from U. S. Fish and Wildlife Service

By W. L. McATEE

MENOMIN, or manomin, is an Algonquin word that mean good berry. It is a fitting name for the best wild grain crop known, one that for centuries has been a main source of food for Indians of the upper Mississippi Valley, and important enough to be warred over on several occasions. Menomin, the good berry, is none other than wild rice, or the *folle avoine*—wild oats—of the early French explorers.

The French and Algonquins were allied against the Iroquois but were driven westward by that warrior race. There the Algonquins settled down for a time and formed local tribes. One of these living in the region about Green Bay, Wisconsin, found wild rice, menomin, so important an element in their existence that they took, or were given, the name Menominee, or wild rice men. The river that divides the Upper Peninsula of Michigan from Wisconsin, and the southernmost county in that part of Michigan, are called Menominee to this day.

The Indians themselves still thrive in a colony of about 1800 on a reservation in north-central Wisconsin. They continue to depend much on wild rice for food, have retained their old beliefs as to its origin, and have kept to the old ways in harvesting it.

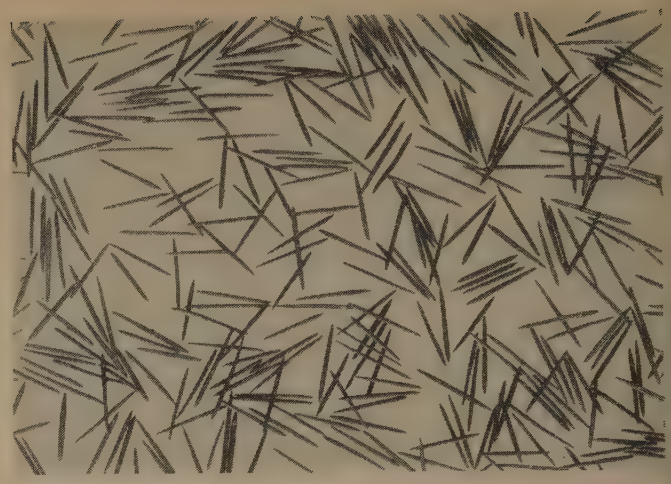
Menomin, being a product of earth and water, is, according to their belief, the gift of one of the underneath beings, probably Sekatcokemau. As the time for the rice harvest nears in fall, the Indians gather on the shores of the good rice lakes, pitch their lodges, and prepare to gather the grain. The children are warned to refrain from boisterous play, the elders are more than usually dignified, and guards are appointed who see that no one who is not authorized goes to the wild rice fields before the appointed day.

This day is determined by scouts who examine the rice from time to time to see if it is ripe enough. When the day is set, criers go about from lodge to lodge shouting, "Tomorrow we will begin the harvest." That night the chief of each band makes a sacrifice to Sekatcokemau. He gives a feast, with prayers, and a speech saying, "We are going to commence to pick our rice tomorrow." Then, turning to the people, "We make this offering to our Grandfather, the Master of Rice, who caused it to grow for our use. We give this tobacco [with these words he digs a small hole in the ground, and puts tobacco in it] as an offering to the Underground Powers, and we ask them to permit us to make the harvest. We beg for four days of good weather and then we will leave the rest of the rice to the Thunderers for their use." Here the chief rises and throws tobacco into the fire as an offering for the Thunderbirds. "May they permit us to pick for four days in the fields, which they and the lower gods have given us; then they may take their share." At the conclusion of this speech, tobacco is passed about and the old people smoke in honor of the gods, after which the feast is eaten. (The ritualistic formulas presented here are quoted from Alanson Skinner of the Milwaukee Public Museum.)

Wild rice is a stately yet graceful grass. Sometimes it attains a height of twelve feet and a stem diameter of two inches. When the flowering heads are full of yellow anthers it is truly a beautiful plant.

The gods having thus been propitiated, the gather-

The grains of wild rice in their husks, including a long, slender beak, are one and one-half inches, or even more, in length.



The hulled kernels, suggesting sections of pencil lead sharpened at the ends, measure from one-half to three-quarters of an inch long.

ing of the rice begins. As the plant grows in waters having the softest of muddy bottoms, the grain is gathered by knocking it off into canoes pushed through the fields. The boats go back and forth making each new swath as close to the last as possible. Great care is taken during the work not to offend the manitous who rule the water, by wasting the rice, or otherwise, and no person ceremonially unclean is allowed to take part in the harvest.

When the canoe is filled with rice, it is poled back to camp by its single male occupant, while the two squaws who have been doing the beating trample the grain to break off the long, sharp beards. When all is ready for continuing preparation of the grain on land, the unhulled kernels are parched in a dry kettle. The hulls crack like popcorn, although not so loudly. When the husks have opened, a hole is dug in the ground and lined with a cloth or staves. A small quantity of parched rice is poured into the hole, and a man with clean, new moccasins steps in, and, holding to a stake driven by the hole, dances on the rice to thresh it. Sometimes he chants a song in time with his trampling.

Now that the grain and hulls are separated, winnowing is in order, and this is done in birch-bark trays on which the rice is pitched up and down, the wind carrying away the chaff. Next the rice is washed to cleanse it of any dirt that may have come in, and of the smoky odor caused by the parching. Then it is ready to cook, or, after drying, to store. In cooking, wild rice absorbs six times its bulk of water and the kernels, like inch-long sections of pencil lead, curl until both ends are brought back to the middle. Thus it has an entirely different appearance from common rice, in fact somewhat suggesting worms. If that impression should lead anyone to avoid wild rice, he would be the loser, as it is a finely-flavored food, and doubtless more nutritious than cultivated rice, as usually served, because it has undergone no polishing process and the outermost and best layer of the grain is intact. The Indians do not try to improve on Nature.

At each new wild rice moon the craving for some of the delicious grain is great and a feast is had the very first day of the harvest. However, dignity and restraint prevail and the gods are fittingly remembered before the feast. The leader offers tobacco, saying "We thank thee O Rice Maker that we have lived to see this season. As we must not partake of thy bounty without tobacco and a ceremony, I am doing this faithfully to carry out our part, to thank thee and fulfill thy wishes before we touch and taste the rice, in order that we may be successful in making a good harvest."

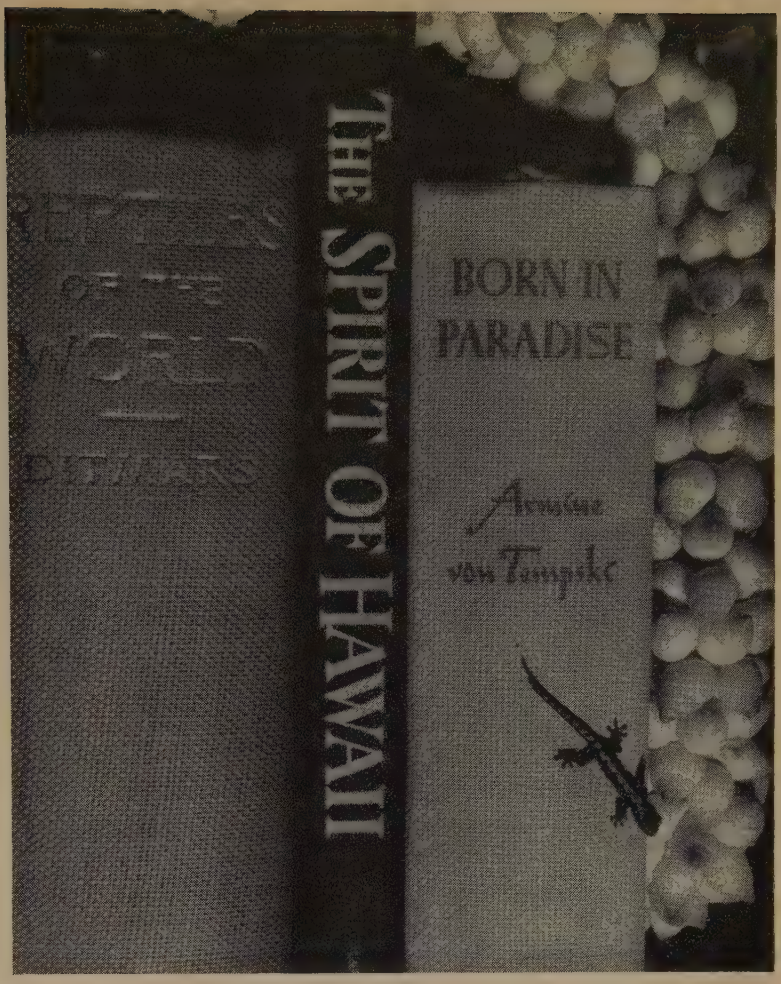
Not to the Menominee alone was menomin of great value, but to all the tribes of the wild rice country. The Chippewas pushed the Dakotas out of the Minnesota lake region in order to possess the rice fields. Early writers refer to wild rice as one of the most valuable of all the products of the upper Mississippi region, and some assert that without it the Canadian trappers and traders of the early days could hardly have existed. At a single post, Rainy Lake, the Hudson's Bay Company purchased from the Indians an annual supply of twelve to fifteen hundred bushels. At a rather small lake, Lower Rice Lake, in Minnesota, more than 2000 bushels have been harvested in a season.

Wild rice gathering is carried on nowadays in a more mechanized way than described for the Wisconsin Indians at numerous localities in Minnesota, and money received for the crop is an important source of income for the Indians. Through State supervision they are now assured exclusive harvesting privileges. The crop is around 500,000 pounds annually and brings the Indians from twenty-five to thirty-five cents a pound, a price that is doubled or trebled for that part of the product that is sold packaged in retail food shops. Quantities of the freshly-gathered wild rice, just as it comes (Continued on page 499)

MO'O, Spirit of Hawaii

By LEWIS WAYNE WALKER

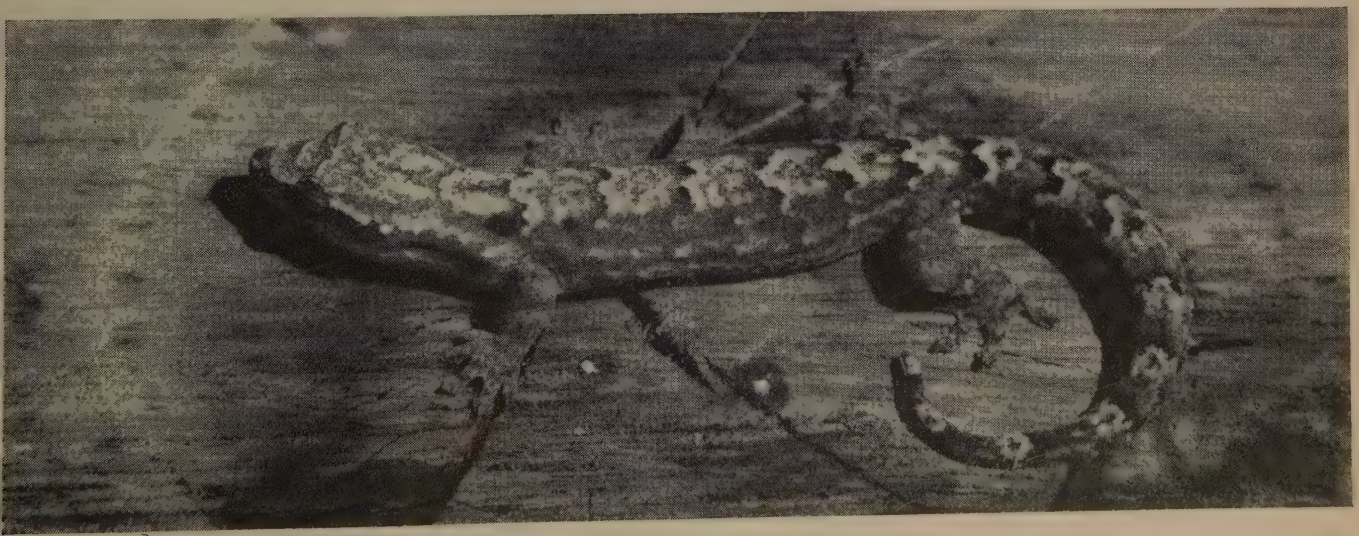
Photographs by the Author

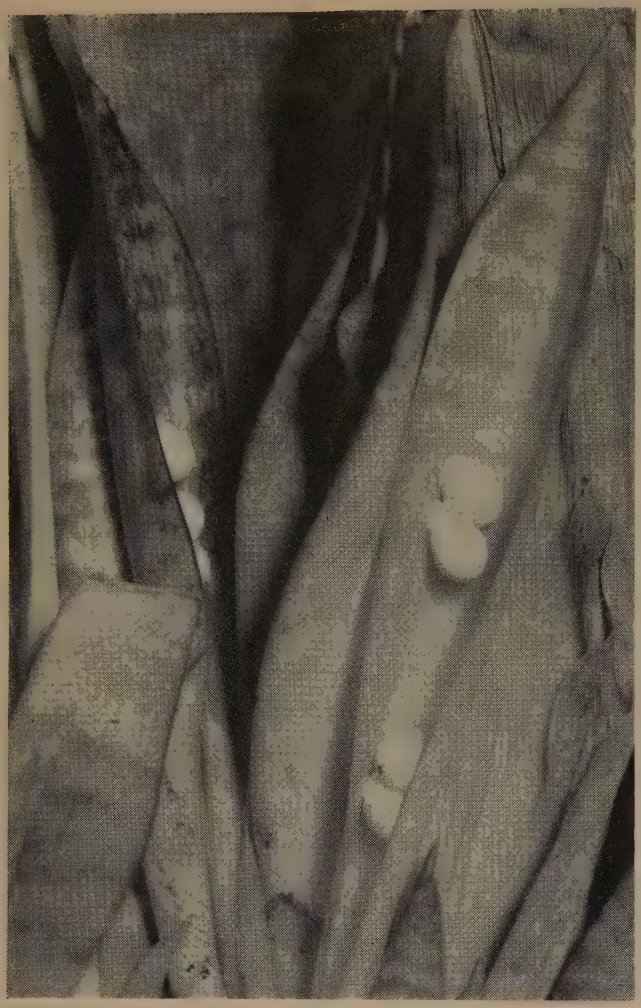


A half-grown gecko with literary tastes explores between the bookends. Below, one of the lizards on a log, showing its natural protective coloration.

GECKOS are by no means confined to the Hawaiian islands, but thousands of Americans have had their first glimpse of these nocturnal lizards in the mid-Pacific. At dusk they have watched these tiny reptiles emerge from cracks in the walls of hastily constructed barracks, and they have followed their travels to the screens where their nightly pursuit of insects commences. A few "wise guys" have tried to hold them as prisoners by placing a finger on tail, only to have the animals scamper away, leaving the trembling appendage as the price of liberty. Others, with time on their hands, have reclined on their bunks and watched the nocturnal lizards. Curiosity soon changes to admiration as they see them stalk insects, then see the insects—particularly mosquitoes—disappear as through drawn into a tiny vacuum cleaner. These men then become the protectors of the geckos, the living symbols of a mythical Hawaiian god called Mo'o.

From the time the Hawaiian islands were created by volcanic upheaval, and until humans trod their shores, there was no reptile life. The exact date of the first landing by man is unknown, but in the verbal Hawaiian history the royal families are traced back about sixty generations to an Asiatic origin. They traveled from island to island in large canoes or barges. After settling and prospering on a speck of land, scouts were sent out on reconnoitering trips. No doubt many disappeared in the trackless Pacific, but others, however, found new lands. Then, with an inherent sense of direction and a workable system of navigation, about which we know little, they were





able to retrace their journeys and carry news of their discovery to those they left behind. Migration followed the routes they described, and on these trips they brought not only personal belongings but their legends and myths, kept alive through repetition, generation after generation.

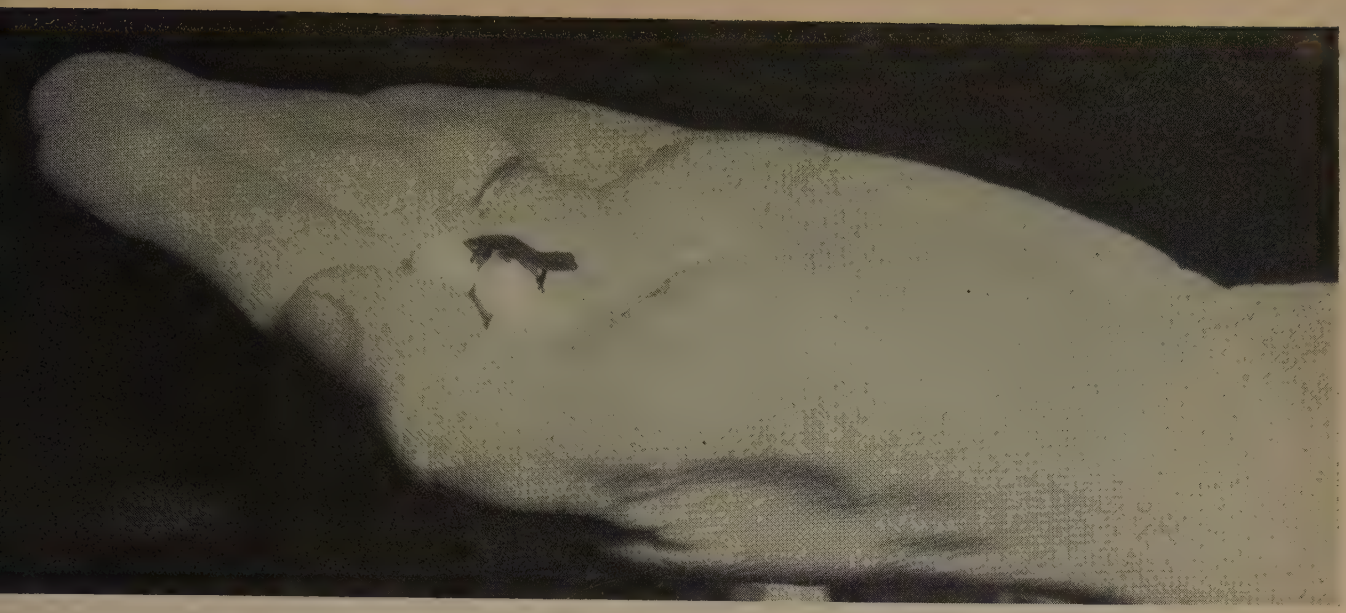
In the dawn of the history of the Hawaiians, they evidently encountered ferocious reptiles. These might have been crocodiles, alligators or pythons, or perhaps even extinct reptilian forms that are non-existent today. Legends were woven around these reptiles. In some stories they played the part of protectors of their many gods; in others they were vengeful enemies of man.

In these same canoes and barges came animate stowaways. They, like the humans, settled, multiplied and moved on from island to island with their hosts. In this way the skinks and geckos reached the Hawaiian islands. The advent of the white explorers just about put an end to the legendary tales, and now they are largely preserved in a few musty books. The geckos, however, have thrived. The cracks in a clapboard house suit them better than the breezy hideaways of a grass hut. Windows, screens and electric lights seem made to order as an aid to their capture of insects. Few stalk their food as did their ancestors of a century ago. Now they hang on glass pane or screen, where a light shines through, and wait for their prey to come to them.

Geckos, skinks and a tiny worm-snake are the islands' only land-dwelling reptilian inhabitants. The snake is confined to an area of about a score of acres, and was supposedly introduced accidentally within the past half century in the roots of potted plants. The skinks, of which there are three species, have a wide distribution, and are found in varied habitats.

There are four species of geckos, widely distributed from sea level to mountain heights. These are the reptiles of the islands that actually seek human habitation and attain the greatest population about dwellings. It is not unusual to see four or five of these lizards standing watch on the woodwork of a window. A moth drawn to the light within barely has time to fold its wings before the geckos commence to stalk. If the insect has landed in a distant corner they will occasionally rush from their place of hiding until within a few inches of their prey. Then they forge ahead in slow motion. Their tiny feet, equipped with suction discs, are lifted and set down deliberately, and just before one of the lizards —usually the largest—gets ready for the spring, its legs are set forward with the body held back. Then, as though on a pivot, the whole body shoots ahead,

Geckos find a wide variety of places in which to lay their eggs, as in the funnel-shaped leaves of a plant at the left and inside a lock, below. Locks, in fact, are favorite spots with the little lizards, and the nursery of many young ones.



A young gecko is an inch and one-half edition of a normal adult, and immediately goes about the business of hunting insects. Four eggs and a youngster take up very little room in the human hand.

the mouth opens, and a lightning-fast tongue snaps down on the prey and pulls it to waiting jaws. Most of the smaller insects are swallowed with a single gulp, but a large common moth of the "miller" type often gives them trouble. Catching one of these, a gecko will start to beat it to death with a sideway motion of the head. This audible thumping often continues until the wings are battered off; then the body is eaten.

The geckos lay their eggs in all manner of places, and most species seem to deposit two. When first laid they are soft-shelled and dent readily, hardening only after several hours of exposure. Within the egg there are the usual albumin and yolk. The embryonic lizard takes on a recognizable form in about two weeks' time. The head is extremely large and the eyes are well developed and prominent. The eggs hatch in about thirty days, although weather is a controlling factor. Most egg-laying reptiles in the United States carefully place their eggs where they will get just the right amount of moisture and heat. The geckos of Hawaii, however, seem to drop theirs wherever they will not be readily seen. Auger holes in two by four ceiling rafters are usually jammed full. In such a position, rainfall and dew cannot reach them. Others are often found at the base of long-leaved plants. In this site the leaves act as funnels and the eggs are constantly drenched with water. But still they hatch! One of the favorite situations is within the iron framework of the common recessed lock. Climbing in the keyhole the females will first start filling the far corners, and each succeeding female is forced to lay closer to the opening until the chamber is eventually crammed to overflowing.

When the young hatch the egg splits across the center and a tiny kinked-up gecko emerges. Within a few hours it completely unfolds, sheds a membranous skin and looks just like an inch and one-half edition of a normal adult. Naturally there is no parental care for either eggs or young, and the newborn lizards commence hunting immediately. Their food for the first few weeks of their lives is made up mainly of small gnats. These are stalked in adult manner. The young geckos are afraid of adults of their kind until about half grown, and these adults are often seen unsuccessfully stalking the infants. There may be a trait of cannibalism present.

Each lizard seems to have his own home territory, which will cover several square yards. This has been checked by nightly observations of geckos that were regrowing lost tails. However, at all times during the year groups of several hundred have been seen in short migrations, usually from a building to some nearby brush. On these non-seasonal trips they will jump from rooftops more than twenty feet high, land unhurt and continue the journey. It is thought that these are nightly forages, and that they return to the buildings before dawn. In undiminished numbers their faint squeaks or "clicks" of protest are heard from the rafters the following morning.

The Wren

By RUSSELL PETTIS ASKUE

His warble is too big for him—
It nearly shakes him from the limb.
He cannot fill the whole warm sky
With music, but he likes to try.

Grow Your Own Fish

By
ANDREW S. WING

U. S. FISH AND WILDLIFE SERVICE PHOTOGRAPH

A typical farm fish pond in the Texas Panhandle section. Such ponds as this can be made with relative ease and supply food and recreation at home.

FISHING has changed in the years since I was a lad on an Ohio farm. We went fishing in the old pond back of the house, or in a nearby creek. What we caught depended on the fish Nature had planted in stream or pond, somewhat on the weather, or our skill, or just plain luck. Nobody seemed to know why the fish were more plentiful one place than another, or why they would bite or would not. Fishing was an adventure in those days. If you caught a nice string of bass or bullhead catfish, or crappies, you were lucky, a good fisherman, or both. But times have changed. Now we know how to grow a crop of fish, and also how to make them more plentiful, just like increasing the yield of any other crop. We even know a little more about why they bite—or do not—but not too much.

That old farm pond back home in Ohio is a fragrant memory indeed. In recent years it became a not too fragrant, stagnant mudhole, unfit for man, beast or fish; inhabited mostly by mud turtles and frogs. Then it was drained and converted into land that would grow crops. Properly managed it might have yielded more as a pond than it does as a corn field. But to a hard-headed brother, the job of soil management was more appealing than that of keeping a small body of water productive of finny livestock. In many sections of the country, farmers and other country dwellers are turning swamps, ravines and other likely spots into fish ponds. They are using scientific methods to make these ponds grow fish in tonnage figures that compare favorably with cattle or other livestock.

That old pond of ours was a "made" pond, formed by building a dike across a naturally swampy spot and running a series of drainage ditches into it. But even when I was a lad, it was old enough so that it was overhung with large willow trees where one could drop off a limb into deep water. The pond was about two acres in extent, and the water near the shore was free from weeds and pond lilies. Farther out was a ring of yellow "docks" and white water lilies. In the middle was a deeper hole where the "big" fish lay. It was "over our heads" and had to be fished from an old flat-bottomed boat.

Trying out their luck in the farm fish pond, made by taking advantage of the terrain and sources of water.

The fish were few in variety but fairly numerous. Mostly they were common sunfish, "sunnies" or "punkin seeds." But there was also a goodly supply of the ordinary catfish or bullhead. The sunfish would bite at almost any time, rain or shine, but they were small and bony. However, they were fun for a small boy who craves action by his bobber. The catfish

were considerably larger and much more temperamental. They took their time, nibbling slowly at the worm until hooked, and then the cork would disappear. If the fish was large, and if the line was long and attached to a limber bamboo pole it would give a real battle for a time. The catfish would seldom bite on a sunny day, preferring cloudy weather or evening to do their feeding. Catfish are an excellent table fish, the flesh being sweet and relatively free from bones. But they had to be skinned, and that process involved a tussle with the tough hide and many a prick from the sharp "horns."

Someone stocked the pond at one time with both black bass and pike perch. No one ever caught any that I can remember, perhaps because we did not know how, or, more likely, because there was too much natural feed. One hard winter, I recall, a number of large fish were frozen in the ice, and that, I think, was the end of the bass and perch.

As we grew older and wiser in the ways of fish we took to stream fishing in nearby creeks, some of which were quite well stocked with bass and other game fish. The old pond was silting up, becoming muddier and more choked with water weeds and algae. It was full of "snapping" turtles and land turtles, which no doubt did not increase the fish population. But mostly, I am sure now, it was lack of proper management that caused the fishing to run out. If the pond had been cleaned to reduce the coarser vegetative growth, and if its waters had been "fertilized," no doubt the fish crop would have been larger and the old pond, with its cool shadows on hot days, and its silvery ice, where village boys and girls used to skate in winter, would still be a neighborhood institution and not just a happy memory.

PHOTOGRAPH FROM ALABAMA POLYTECHNIC INSTITUTE

Both of these breams were photographed one year after stocking in a farm fish pond, the one above in an unfertilized pond and the one below in a properly fertilized pond. At the top and bottom of this page youngsters proudly display their catches from a farm fish pond.

We now know more about pond management than we did then, and the trend is towards more home ponds. This is particularly true in the South, in the middle West and the Northeast. Where the streams are spring fed, especially in the mountainous regions where the brooks are fast, clean and protected by overhanging trees or by large rocks, the gamy trout and the small-mouth bass are planted. In small ponds and lakes where the water becomes warm in summer, large-mouth bass, blue-gill sunfish, perch, pickerel and bullhead catfish thrive better and are more commonly used.

The best size for a home fish pond is one to three acres. Smaller ponds are possible if properly managed; in fact, good fishing can be had in fertilized ponds of as little as one-half acre. Trout may be grown in even smaller pools if the water is fresh and cold, but will not stand temperatures higher than 70 degrees F. in summer, except for very brief periods. For that reason, spring-fed streams are usually better for trout, except where natural conditions keep the lake or pond cool throughout the hot weather season. For the average family, therefore, the made pond of from one-half to two acres will be most practical, and the fish population will consist of the usual sunfish, large-mouth black bass and catfish.

But first comes the pond. This is not the place to describe how to build one. There are plenty of bulletins and technical papers that give that information. It is enough to say that an earth dam with a cement core will do. The pond should be located in a ravine, or other low spot, where there will be a natural supply of water sufficient to keep it filled, either from a small brook, from springs, or from the drainage of surrounding fields or woods. A swampy spot or poorly drained location is ideal as that land would not be

productive anyway, and there is usually an adequate water supply. Often dredging will be unnecessary except to scrape up enough dirt for the dam. The cost of such an operation will depend on the location, the length and height of the dam and other factors, such as local labor conditions. Plans can be made immediately, and will provide many an evening of pleasant family conferences. Here is something that will have a great appeal for the young son or daughter, and especially the boys who have been overseas, and who need something to keep them occupied as they try to adjust themselves to the humdrum duties of civilian life.

It has been suggested, and with much common sense, that every community should have a swimming pool after the war. What could be finer in the way of a living war memorial than a small lake or pond where the young people of the town can congregate on hot days to swim or fish, or to skate in winter? Suitably landscaped and equipped with tables, benches and outdoor fireplaces, such spots could be made an asset for recreation and beauty in thousands of villages and cities where such facilities do not now exist. It would undoubtedly contribute to the movement from crowded industrial centers back toward the more open spaces. Wholesome neighborhood recreation would tend to encourage young people to stay nearer home rather than seeking the bright lights of the big towns.

As one who grew up in a farming section, far from the ocean or any other large body of water, I can testify to the irresistible lure of a lake or river for a growing boy or girl. With gasoline and tires again plentiful, our highways will be crowded Saturday nights and holidays with youngsters in search of fun and adventure. The closer we can keep them to their homes, the fewer traffic accidents and the less juvenile delinquency there will be. Town fathers, youth leaders and all who have the well-being of the younger generation at heart would do well to consider this suggestion.

Once the pond is built and full of water, the first thing to consider is stocking it with fish. These can be obtained from state or commercial hatcheries at a moderate cost, or, sometimes, without charge. Naturally, the larger the fish the more they cost and the more difficult they are to transport, so the small sizes are usually obtained, except where they are to be used by fishing clubs or in waters where immediate results are wanted. But even before stocking, one must attend to the vital matter of feed. Pond fish feed largely on microscopic animals, insects and small fish that inhabit the pond. The small animals live largely on microscopic plants. It is an interesting and important fact of life that it is the water plants that develop certain vitamins through the strength of the sun's rays. The small fish eat the plants and the large fish eat the small fry, the final result being that you and I get our vitamins from the fish, either from their flesh, or, in more concentrated form, from the livers of such fish as the cod, shark or halibut.

The microscopic water plants cannot exist without the same vital minerals that land plants use. So, in order for them to thrive, the water must either be naturally rich in phosphorus, nitrogen, potassium and the lesser plant food elements, or else this plant food must be supplied artificially. How important these minerals are is shown by the fact that in Alabama ponds that were unfertilized supported only from forty to two hundred pounds of fish to the acre. Properly fertilized ponds, in contrast, supported five hundred to six hundred pounds of fish to the acre, a larger crop of concentrated food, one might add, than could be expected from cattle fed on a fine bluegrass pasture, or even a good field of corn. Furthermore, the plant food is supplied in exactly the same form as it is applied to crops—as chemical fertilizer.

The method of fertilizer application varies, but it is usually broadcast from a boat, or from the shore over the shallower portions of the pond. This is usually done from eight to fourteen times a season, at the rate of one hundred pounds of 6-8-4 (N-P-K), plus ten pounds of nitrate of soda per acre. Or the mixture may be made up by the process of buying the various component parts and mixing them. The cost of treating an acre for a season will vary from $11 to $20, which is little enough to pay for a five-hundred-pound fish crop. Application is made early in the spring, unless the pond is subject to flooding, in which case it should be delayed until danger of flooding is past.

When it comes to stocking, the fish culturists have that all figured out, too. For instance, if you want a combination of blue-gill bream (sunfish) and large-mouth black bass, you will add fifteen hundred bream fingerlings to an acre in late summer, fall or winter. The black bass are added at the rate of one hundred in fall or winter, or as fry the following spring. These quantities are for an acre (Continued on page 496)

Visitors

By LALIA MITCHELL THORNTON

The selfish willows crowd about the pool,
So close it seems no wanderer could know,
And come to steal its waters sweet and cool.
But all night long the little people go
On softly cushioned feet; and so they make
A trail that reaches to the very brink
Through checkerberries, jimson weed and brake.
While all day long the thrush and swallow drink
And flutter wings and bathe along the edge,
While dragonflies, and gnats and honey bees
Share in its nectar. How could any hedge
Want to shut out such visitors as these?

The Jump in the Jumping Bean

By LILO HESS

Photographs by the Author

ONE and three-quarter million of Mexican jumping beans are reported to have been sold by one company alone in one year. At between 3200 and 3500 beans to a pound, that is quite a few pounds. This demand has grown because of games that utilize the bean. And with this widespread use of the bean, the question is often asked, "What is this bean anyway; where does it come from; what makes it jump?"

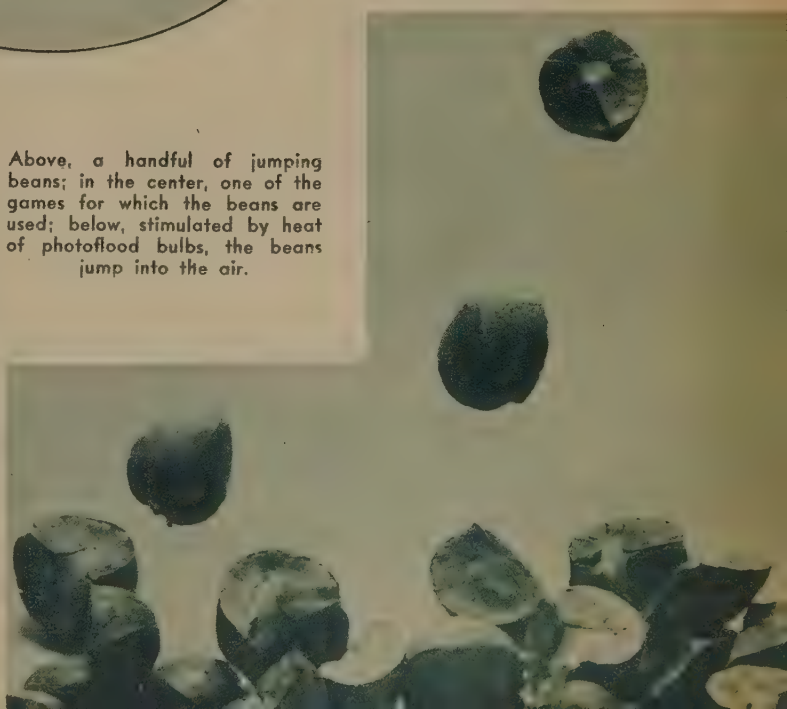
The bean is really a one-room apartment for the larva of a little bean moth known to entomologists as *Carpocapsa saltitans.* The bean comes from a spurge, a bush four or five feet tall and known as *Euphorbia sebastiana.* It grows in Sonora and Chihuahua, Mexico, producing a greenish blossom that becomes buff or gray as it matures. One blossom produces three seeds, triangular in shape with one convex side.

The little moth lays its eggs in the flower, or in the still green and tender seed pod. When the egg hatches it is inside the hardened shell, and enclosed by the juicy meat of the bean. This provides food for the larva, which slowly eats out the interior of the bean until only a hollow shell remains. Then the caterpillar sets to work to line the chamber with silk, which it emits through a tiny spinneret in its head. While this is going on the bean becomes a jumping bean and is marketable.

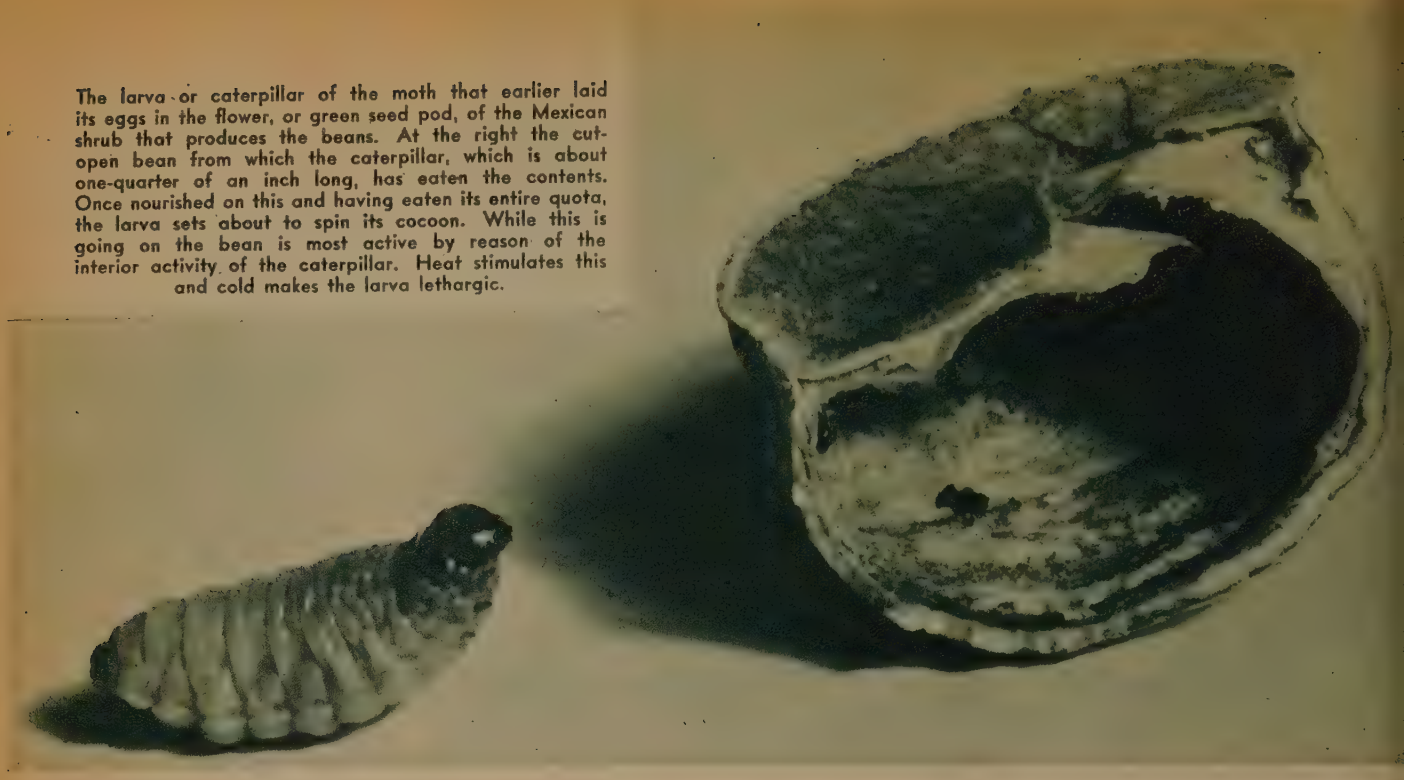
The caterpillar is about one-quarter of an inch long. It has a soft wax-like body, and a hard, reddish head. The head has a few short hairs, eyespots, and well-developed mouth parts. There are sixteen legs, terminating in grasping feet, arranged in two rows, one on either side of the under part of the body. A group of three pairs, called true legs, near the head, eventually become the legs of the moth.

The jumping of the bean is caused by the active shifting of weight inside the shell as the caterpillar moves and turns from one side to the other. The more active and sudden the swings from side to side, or top to bottom, the bigger the jumps of the bean.

Since the caterpillar has no desire to release itself from its home, and since it is usually very active, the beans are more or less in



Above, a handful of jumping beans; in the center, one of the games for which the beans are used; below, stimulated by heat of photoflood bulbs, the beans jump into the air.



The larva or caterpillar of the moth that earlier laid its eggs in the flower, or green seed pod, of the Mexican shrub that produces the beans. At the right the cut-open bean from which the caterpillar, which is about one-quarter of an inch long, has eaten the contents. Once nourished on this and having eaten its entire quota, the larva sets about to spin its cocoon. While this is going on the bean is most active by reason of the interior activity of the caterpillar. Heat stimulates this and cold makes the larva lethargic.

constant motion. The marvel is that so much energy can be stored in so small a space.

The jumps of the bean are stimulated by heat, as from the palm of the hand. With photoflood bulbs at one foot distance, giving a heat of 140 degrees, the beans will jump upward from one-half to one inch.

The larva lives and moves in its shell for several months. If a part of the bean is cut away, the cater-

If a side of the bean is cut away the caterpillar will spin a web across the opening. When the cocoon has been spun, the insect makes an opening at one end; this is opposite a hole the young insect has already cut almost through the shell so that the moth can emerge when it transforms in the cocoon.

pillar spins a fine net over the opening. In June the beans are active, slowing down in September and by October active only when exposed to heat.

Although not yet to leave the shell, the caterpillar prepares a way for the adult moth. It cuts a circular opening almost through the shell, leaving only the paper-thin outer husk intact. Then the caterpillar spins a small cocoon with a similar small opening at the top, facing the opening in the shell. In this it changes to a chrysalis. In spring the moth pushes through the thin covering, head first. It is a mottled gray and brown moth with large eyes, six legs and is about one-half inch long. It flits away and later starts the cycle of jumping beans again.

The moth pushes through the little hole already cut by it when younger. Below is the chrysalis of the little bean moth, and the moth and its empty chrysalis. The mottled gray and brown moth is about one-half inch long.

At a tender two and one-half months Hugh Blaine Davis meets the ten and one-half-month old baboon, Carmeleta. There seems to be some lack of enthusiasm on the youngster's part, and a certain jealousy on the part of the baboon. Actually she resented the baby, since he came after she did, but they later became great pals. Carmeleta's story was told in the August-September issue of Nature Magazine for 1942.

At seven months, Blaine shares his bottle with a white-tailed deer fawn which seems to appreciate the favor. Later one of the big events in the boy's life was the motion picture "Bambi". He saw the movie every chance he got, and lives in hope that it will be brought back for reshowing

Never A Dull Moment

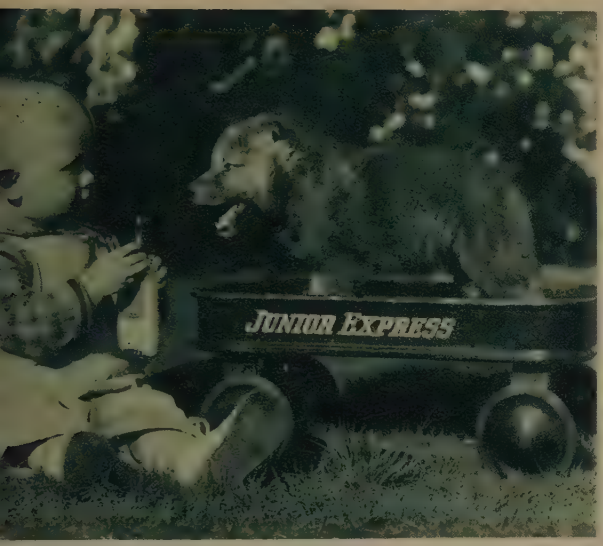
HUGH BLAINE DAVIS is the young son of Hugh Sterling Davis, director of the Tulsa, Oklahoma, Zoo, and naturalist, photographer and lecturer, and Zelta Davis, photogenic companion of husband and son on lecture tour and afield. Ever since he was able to sit up and take notice, Blaine's life has been one animal after another—newcomers to the zoo and to the Davis' household. The young man's dad has recorded meetings with these animal friends, some of which are presented on these pages.

Mr. Davis is convinced that parents are solely responsible for fear of animals instilled in children as they grow. The baby, he says, is born without fear of mammals, birds, reptiles and insects. Any child can acquire the ability to handle them understandingly and instinctively, he believes.

Blaine was taught that only "pet" animals and birds should be taken in the hand. He was shown that a wild animal that had not been made a pet would bite or scratch because it felt that it had to protect itself. However, Blaine is always accompanied by his parents when he handles these animals. A child might, if unwatched, unwittingly hurt an animal and bring about the natural reaction. Despite their interest in animals, and the early enthusiasm for them on Blaine's part, his parents do not feel that he will necessarily be a naturalist.

There is a quizzical look in the eyes of bundled-up Blaine on the event of his first introduction to a dignified penguin. At eight months the baby was given some unusual toys to play with—mountain lion cubs only one month old. They seemed to enjoy rather than to resent a little rough treatment. Mr. Davis observes that lions make good pets if taken young, although they seem to develop a preference for one master. Later the cubs will lose their spots and take on the gray brown of the adult cougar. At the right, Blaine is about to take a ride on the back of a nine-month-old African lion. He is all dressed for the event, but does not appear to be too sure about his mount.

A skunk came into Blaine's life when he was eighteen months old. It was, however, a baby skunk that seemed not to mind a bit of rough handling, so long as it was not suddenly scared or hurt. The baby looks at the skunk face to face, then something seemed to go wrong, and Blaine appears about to embark on a good and lusty yell. The skunk is apparently wondering what it is all about, and is ready to make its get-away.



There seems to be some doubt as to who is going to get the bottle, Blaine or the young timber wolf. At least the pup looks eager, and the young man in doubt as to whether friendship goes quite that far. Baby timber wolves, says Mr. Davis, make good pets when brought up from very young cubs. This is the young of a Canadian wolf.

Blaine affectionately cuddles a pair of one-month-old African lion cubs. At this age the young lions are not too aggressive, and have not yet gotten so large as to be rough. Later they may be playful, but do not realize their own strength. They may snarl defensively when first picked up, but are quite docile once a friendly basis is reached.

Among other things, live indigo snakes travel with the Davises on lecture tour, and Blaine has found one in a suitcase. He is two years, eight months old here, and snakes are all in the day's events so far as he is concerned. He helps his parents display the snakes during stage performances in schools. Mr. Davis observes that youngsters are not afraid of snakes until their elders have taught them to be. Blaine shows the indigo snake to the baboon, Carmeleta, now three and one-half years old. She has no fear of snakes, either, for she has been brought up with them and has appeared with them on the stage. At the right, Blaine and his mother have their hands full of young African lions. When Blaine reached this age—two years, nine months—he had acquired great pride in his pets and delighted to show them off.

Ducks Are on the Wing

HEADED for wintering places in the South, ducks are on the wing along the flyways from their breeding grounds in northern United States and in Canada. This migratory flight is, of course, of interest to the duck hunter, who waits in his blind to decoy and lay them low. It is fully as much of interest to those who wish to observe or photograph the birds as beautiful members of the bird community.

Mainly through overshooting, our ducks reached a tragically low figure in the early thirties. Certain species seemed destined for extinction. Restrictions on shooting, improved conditions in some breeding areas, a great expansion of the refuge system and reduced hunting pressure of war years have combined to aid a comeback of these waterfowl. Most species seem relatively safe today, and, unless hunters' greed forces too great liberalization of regulations, everyone should be able to continue to enjoy our ducks of all species, tomorrow and for many tomorrows.

Of the one hundred and sixty-nine species of ducks to be found throughout the world, forty-two are found in North America. These include the surface-feeding ducks

Mallards and wood ducks feed together in a wildlife refuge, and, below, a concentration of canvasbacks on Lake Merritt, California. U. S. Fish and Wildlife Service photographs. At right, a baker's dozen of mallards on an early morning sail. Photograph by Leo Jobin.

A pintail drake, photographed by Leo Jobin in British Columbia. This duck has the widest breeding range of all ducks on this continent. It is a handsome species, a swift and graceful flyer, with slender neck, pointed wings and elongated tail, streamlined body.

The buffle-head, also called the butterball, is a very small duck, only slightly larger than the smaller teals. One of the diving ducks, it is swift and direct in its flight, which is usually low over the water. It usually nests in large woodpecker holes. Photograph by Jobin.

A pintail duck mother and her brood sail sedately on the waters of the Lower Souris National Wildlife Refuge in North Dakota, where many birds raise their young. U. S. Fish and Wildlife Service photograph.

that frequent inland rivers and lakes; the diving ducks that breed inland but winter mainly on coastal waters; the mergansers, three forms of which are found in North America; the ruddy duck, and the tree ducks.

On these pages are pictured only a few of these interesting birds. To know them better one should turn to a good identification text such as *The Ducks, Geese and Swans of North America* by F. H. Kortright. Such a brief glance at ducks as space permits here can only stimulate interest in further knowledge of the birds.

To the bird student the ducks are particularly fascinating because of their variety of form and plumage. It is not a question alone of learning to know a bird as it looks in the breeding season, but of learning its appearance at different times of the year. Male and female are usually different in plumage, and some in late summer pass through a stage when old and young of both sexes are much alike. It is all quite startling but also challenging to one who would know his birds. The attire of the downy young is also most interesting.

Pintails in flight along the shore of Lake Darling in the Upper Souris National Wildlife Refuge in North Dakota, where they nest in some numbers. U. S. Fish and Wildlife Service photograph.

of green-winged teals, llest of our ducks. The s second only to the luck in beauty among ks. On the wing these y rapidly in compact Their erratic flight and ize usually suffice for cation when flying. Photoaph by Leo Jobin.

Barrow's golden-eye is often known as the whistler. It is almost entirely a North American duck. It breeds in the far West and in Labrador, having eastern and western ranges. It frequently raises its families on high mountain lakes in the Rocky Mountains in our west and in Canada.

At left, a spoonbill or shoveller duck. It belongs to a widely-distributed group that, in habits and form, are much like the blue-winged and cinnamon teals, except for the huge bill. At right, the popular canvasback, exclusively a North American duck. It is distinguished from its relatives by its profile, the upper mandible and crown forming nearly a straight line. Photographs by Leo Jobin.

A Pair of Jacks

Photographed by J. W. Jackson

EQUIPPED with tremendous ears, long and powerful hind legs, jack rabbits are interesting, numerous and often pestiferous dwellers of the western plains and mountains. Here, above, is a white-tailed jack rabbit, and, at the right, his black-tailed cousin.

Just as the cottontail rabbit announces itself by its tail with the white underside, the white-tailed jack has a conspicuous white appendage. It is larger than the black-tailed, believed to be a faster runner, and capable of leaps of from twelve to twenty feet. White-tailed jacks live on the prairies and open plains, but often range high on slopes of mountains.

Black-tailed jack rabbits are more abundant than their cousins, and frequently a pest to the farmers, who organize drives against them. The black tail may be recognized at considerable distances. When being chased it will often punctuate its leaps with a jump that is higher than usual, apparently for a better view of its pursuer.

As We See It

★

NATIONAL DDT'S As anyone who passes a drug store or reads a newspaper these days well knows, DDT is on the market. This, we believe, is a dangerously premature release to the general public of a potentially tremendously valuable insecticide. We do not yet know definitely what it will kill and what it will not kill; we do not yet know the proper doses and combinations; we do not even know whether there may be delayed menace to human life in DDT. Nor do we know its long-range effect on soil organisms or plant life.

We do know that DDT is lethal to many species of beneficial insects; that, sprayed five pounds to an acre, birds are killed; that, sprayed to kill mosquitoes and flies on a five-mile stretch of coastal forest, it left an appalling residue of dead fish and crabs on the shore; that it is particularly fatal to cold-blooded animals.

Rockford, Illinois, faced with infantile paralysis in epidemic degree, sprayed DDT from airplanes, apparently on the questionable theory that flies have something to do with polio. The experiment was much more spectacular than scientific, and Rockford may well become a biological desert as a result. With the seasonal decline in polio cases, the Rockford experiment may erroneously be hailed as successful, stimulating other as yet scientifically unjustified atomizing of communities with the insecticide.

The speed and abandon with which DDT has gotten on the open market have exceeded even our direst fears, as expressed in article and editorial in March of this year. This is typical of our American habit of going off at half-cock; of destroying resources in over-weening enthusiasm, only to be faced with regrets and the problems of restoration later. The whole history of natural resources is filled with such examples—lands reclaimed for farms that should have been left for wildlife; lands cleared for agriculture that should have remained in forest; streams polluted by human and industrial wastes that should have been preserved for their natural biological values. And now DDT rushes into general use with serious threat to wildlife, economic life and, perhaps, human life.

About all that can be done, under the circumstances, is to warn again that use of this insecticide should not be indiscriminate. Try it with household pests, but keep it out of the garden for the time being. Wait until we know what it will do and how it will do it before risking extensive and perhaps irreparable damage. With other good and adequate insecticides available, we can afford to be careful.

★

FM AND MT. MONADNOCK One of the newest alphabetical combinations added to our language is FM, which means frequency modulation. This, as we understand it, is a great improvement in radio broadcasting technique and reception, and that it depends for its success upon transmission through the ether from considerable heights, after the fashion of television. It seems that the curvature of the earth is an obstacle.

Whatever the intricacies of this may be—and to us the radio will always be an amazing instrument—the broadcasting people have stirred up a hornet's nest through a plan to erect a FM broadcast station atop Mount Monadnock in New Hampshire. Among the organizations that have stepped forward in protest is The Wilderness Society, which declares that "this summit, the one spot visible from every New England State, and revered through New England's history as an inherent part and symbol of the region's landscape, constitutes a key feature and influence in crystallizing a spirit of allegiance for a significant portion of America's countryside. . . ."

In a resolution opposing this project, the Society holds such values high, and declares that they would be irreparably impaired by such prostitution of this mountain top. Further, its use would be repeated elsewhere, with other defacements of high spots by the installations themselves, and the roads necessary to get to them. It is contended that there is substantial evidence that FM needs can be equally well met by the use of area and altitudes other than Monadnock.

We believe that The Wilderness Society, The Association to Protect Mount Monadnock, and others are in the right in opposing this invasion of Monadnock's summit. We have no desire to throw sand in the wheels of progress, but we see no reason why the super-scientific age into which we seem to be moving has any more right than any other manifestation of so-called civilization to first consideration. We believe that there is more inspiration in Monadnock, intact, than there is in the most beautiful music or the funniest comedy that might be put on the air from among the clouds about her peak.

Malibu and Gato from the author's wildlife farm as they were seen as actors in the M.G.M. motion picture of the wild, "Sequoia."

The Doctor Goes Wild

By VANCE HOYT

ALMOST everyone is interested in the outdoors in one way or another. This seems especially true directly following a war. Then the call of Nature seems to be the greatest.

My outdoor hobby began right after World War I. It started with an all-year, weekend cabin built to relieve the strain of a city medical practice. But before we knew it we had "gone wild."

Because our retreat was only a thirty-minute drive from Los Angeles, we had no idea that it was actually in a wilderness unique unto itself. During the first year, we had no time in which to investigate the surrounding mountains, with their rugged canyons and peaks, covered with a heavy growth of chaparral. The next year, however, when we spent the summer at our hideout, we found that we had settled in the midst of a wildlife paradise.

The days were glorious with the songs of birds and the jolly calls of mountain quail. The little burrowing owl called far into the night, and from the depth of the oaks came the deep and weird *who who too-o-o who-who-o-o-o-o* of the great horned owl. Not infrequently the shrub-scented darkness of pre-dawn would be disrupted by the distant bark of a fox, the satanical yipping of coyotes, or the scream of a bobcat.

Sometimes we were awakened by the stamping of browsing deer about the cabin; the chirring of prowling raccoons; the cricket-like chirpings of a family of skunks on parade. For a while, a pair of ring-tailed cats made our front porch a speedway for their nightly romps. And, of course, the frisky pack rat was ever present with his night-long thumpings as he capered beneath the flooring of our bedroom.

On a leash, Gato goes out for a stroll, often to the consternation of other pedestrians.

Less than a hundred feet back of the cabin, on the rim of a wooded canyon, I had dug a pit in which to put scraps from the table. We hoped this would attract some of our wild neighbors so we could photograph them. A few days later, while eating dinner on the rear porch, Mrs. Hoyt suddenly exclaimed: "Look! There's something at the pit." Then,

The wildcat seems to have some doubt about the business of being photographed, and the expression suggests either a sneer or a threat. At the right, Bar-Rac, the raccoon, and Zorra, the fox, talk things over. Complete pals, the conversation is unquestionably friendly, but may involve some conspiracy or trick the pair is up to. Below, the interior of the author's cabin, the author and Zorra. Dr. Hoyt and his wonder fox seem to be enjoying the fireplace in comfort.

in a hushed voice: "Oh, it's a fox! Isn't he gorgeous?"

Frozen in a pose of stealth and beauty, a large gray fox stood at the edge of the pit, looking directly at us. His coat was mottled gray and black, with white and russet about neck and legs merging with the creamy yellow of his breast. And the black sheen that ran from the nape of his neck to the tip of his plumy brush framed the graceful curves of his back against the golden rays of the setting sun.

We had never seen a wild fox before; and this little animal seemed the most beautiful and intelligent creature I had ever set eyes upon. In an instant the fox vanished into the brush as mysteriously as he had appeared. But that moment remains the most impressive in my memory, because I knew at that instant I had found my hobby—to know wild animals; to study them; to meet them on equal terms; to write about them.

I set out to make friends with our caller. Within a few weeks, Silver Boy—as we called him—was taking food from our hands. But that was not all. Our liberal table must have been advertised far and wide by the fox. Soon many eyes shone in the night about the pit. Raccoons, bobcats, coyotes, skunks and ringtailed cats were regular visitors. Some of them even came to the cabin door.

But Silver Boy was our favorite. We became so attached to him that one night I coaxed him into a pen and set about to domesticate him. I taught him to lead on a leash; to ride in the car with us; to sleep on the hearth at nights. And during the three years he was a member of our family, not once did he bite us.

By now we had conceived the idea of turning our hideout into a wild animal ranch, and our hobby grew into a vocation that culminated in a series of Nature-novels and motion pictures.

At one time we were supporting more than thirty-five inmates in our Noah's boarding house, and learning about animals. We found that our charges had distinct personalities. Some were clever, keen to learn, real schemers. Others were torpid, less quick to catch on. But no matter how they differed in disposition, they all possessed the fundamental emotions of human behavior, such as fear, love, hate, jealousy, loyalty, treachery. Some seemed to be blessed with a sense of humor—a rare trait even in mankind. This was especially true of the foxes and raccoons.

Also their racial characteristics were surprisingly pronounced. A raccoon is as willful and stubborn as a bear; a fox is lovable and loyal as a dog; a bobcat or cougar is jumpy and selfish; a skunk is self-centered, haughty and disdainful in the might of its ways; a deer is as harmless as a lamb when young, but can be as treacherous as a bull when matured and in the rut.

Certain virtues were found in all of them. They had a strong sense of justice with respect to personal rights. But the one trait that kept our large family together on equal terms was the play instinct. Play teaches young animals how to use their muscles in

"sets." Thus the animals most playful when young usually become the most agile and elusive when matured, the quickest to catch prey and the fastest runners in eluding danger.

In a large enclosure that we called the nursery, I had placed the young of almost every species we had captured and bred—baby bobcats, coyotes, foxes, skunks, ring-tailed cats, raccoons, cougars, fawns, and a couple of bear cubs I had caught in the High Sierra. They got along surprisingly well. In fact, they were more friendly toward one another than members of the same species probably would have been.

This nursery gave birth to an idea that was destined to give pleasure to movie fans throughout the world. I had always believed that environment had more influence upon the individual than inheritance. So in order to prove this theory with respect to wild animals—at least to my own satisfaction—I decided to keep one of the fawns and a cub cougar by themselves until full-grown to see if they would remain friends. We called the deer, Malibu, and the cougar, Gato.

These boon companions lived with us for more than three years. They were not kept in an enclosure all this time, or only taken out on leash. Many times they would wander off together through the wilderness and be gone for days. But they always returned, pleased to be with us again and receive the tidbits we had to offer them—the deer, tobacco and bananas; the puma, beef hearts and boiled lights.

Zorra eagerly awaited her master's return home in the evening, and seemed to know just when he should arrive.

On many occasions I followed this pair unseen, and observed their friendship in the wild. Not once did I ever see the big cat show the least sign of hostility toward the deer, even when I knew the puma was hungry. Yet several times I saw Gato catch game and eat it when in the presence of Malibu. And once, when full-grown, I came upon him at the carcass of a freshly slain doe—which I have every reason to believe he had killed—and Malibu was standing in the offing watching him feast! Certainly Gato definitely knew the difference between his friend and other members of the deer tribe.

After watching young animals make friends, regardless of species, plus experiences in the field, I am forced to agree with William T. Hornaday, who says that asking if animals reason is to him like asking if fish swim. Yet many people will contend otherwise.

Animals do more than think and remember past experiences; they teach their young by example. Young animals are not born with the knowledge of their parents, which they would have to be if their actions can be explained by instinct. At birth, most of them are actually ignorant of the simplest tricks. Even fawns will lie down without regard to wind, which no adult deer would dare to do. They have not yet learned the value of fear. That is one reason why infant animals are so easily domesticated and readily make friends with a member of a deadly species, as in case of our deer-and-lion classic.

Any infant animal has to be taught to feed or hunt, what to eat, what to be afraid of, and how to act under any and all circumstances. Then, having learned what its parents can impart to it from observation and by example, it fares forth on its own. If it is intelligent and strong, it survives. Otherwise, it quickly succumbs and becomes prey of its natural enemies.

But let us consider a few clinical notes from the life-history of Zorra, our wonder fox, the daughter of Silver Boy, and companion of Bar-Rac, a devilish raccoon, and Bobby Bobs, the bay lynx. We brought the three up together as a triumvirate experiment, and called them The Three Musketeers of the Wild. The fox lived for more than five years, when she succumbed to appendicitis. The raccoon was with us for more than nine years, when she died as the result of Kleig eyes acquired during the filming of a Pete Smith short. The bobcat was finally killed by hunters.

Of all the wild friends we have possessed, Zorra was the most intelligent, lovable, and interesting. She was the dog of our household. She seemed to have lost most of her wild instincts. During all the time she was with us, she never once bared her teeth in anger.

But Zorra was no angel; she had her devilish moments, although she was never mean about anything she did. When with her, our time was never our own. She was forever after us to do things for her, and she had a way of getting results.

For instance, if I were reading, and she wanted to go for a walk, she would nudge my leg with her nose. If I did not notice her, she (Continued on page 498)

Kuei-Hua, Fragrant Shrub from China

By MABEL IRENE HUGGINS

The shrub *kuei-hua*, two peonies and a clump of orchids form the decoration on this plate of the Tao Kuang period, A.D. 1821 to 1850. Below, a *kuei-hua* shrub grows beside a great rock on a beautiful Chinese silk fan.

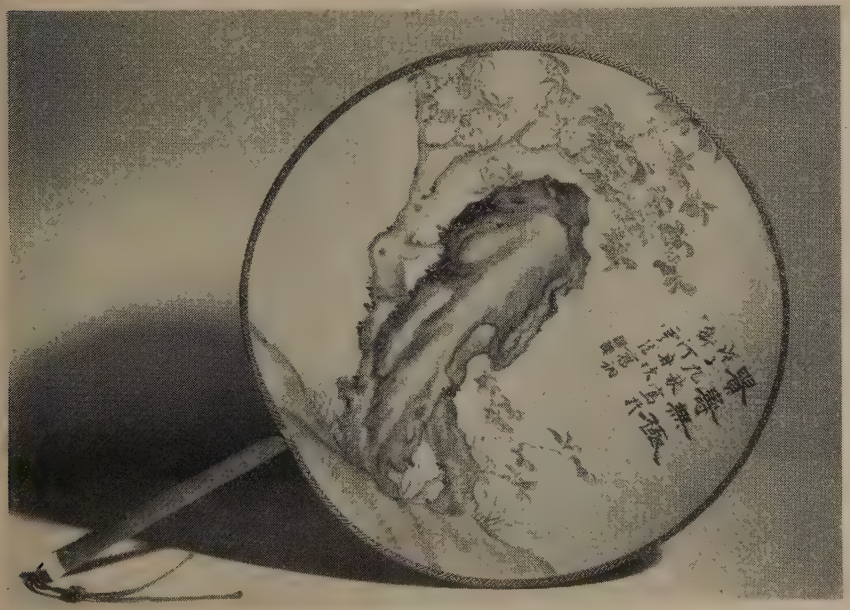
On the hills of South China there grows a shrub which, long centuries ago, the Chinese named *kuei-hua*—and *kuei-hua* it has remained down to the present. Fully two hundred years before Julius Caesar waged war against our barbarian ancestors in western Europe, a Chinese poet had written of the great wind that blew through the shrub *kuei-hua*.

In the Chinese language *hua* simply means "flower"; and the character *kuei* is the same one that is used in the name of cinnamon. The name of the flower is pronounced exactly as is the *kuei* meaning "riches," thus affording a neat play on words, which does not escape the pun-loving Chinese.

It was not until 1771 A.D. that this delightful plant became known to the West through its introduction into England under the name *Olea fragrans*. Quite correctly this name suggests that it belongs to the Olive Family, *Oleaceae*, a family that includes the ash, the privet, the lilac, the forsythia, and the jasmine.

Another scientific name—and the one that now seems to be preferred in America—is *Osmanthus fragrans*. As is evident, it comes from the Greek *osme*, fragrant, and *anthos*, flower. "The fragrant *Osmanthus*"—here is perfection in flower nomenclature. The emphasis upon the fragrance of its flowers gives apt reference to its most outstanding characteristic.

Additional names have been applied—the fragrant olive, the tea olive, the sweet olive, but, as is often the case, the common names are far less adequate than the scientific ones.



In China the *kuei-hua* has not been left to the wild state of its native habitat, but has been transplanted into Chinese gardens, where it flourishes. It is an evergreen shrub with lustrous dark foliage. Along the twigs at the base of the glossy leaves are clusters of small white, or yellowish, flowers, extremely modest if compared with the royal hues of lilacs and forsythias, but nonetheless strikingly conspicuous because of their pleasing and pervading perfume.

The Chinese have a great fondness for their *kuei-hua*, and cultivate it as a potted plant in those parts of the country where the winters prohibit its outdoor culture. The blooming period begins in the autumn and con-

tinues for several months. Particularly throughout the Chinese New Year's season the people delight to have the *kuei-hua* in their homes, not only because they enjoy its fragrance but also because, from its punned meaning, it expresses a wish that riches and prosperity may come during the New Year.

In cookery the Chinese excel. Their cooks have the imagination to incorporate in their viands golden lily buds and snowy chrysanthemum petals, tiny pink roses and sweet-smelling jasmine flowers, so we need not be surprised that they find use for the little *kuei-hua* blossoms. Their fragrance becomes flavor in a variety of syrup that is sometimes made. They are also utilized in a sweet dressing, to which they are added along with peas. This sauce is poured over a certain kind of cake.

COURTESY OF ARMSTRONG NURSERIES

Foliage and flowers of *Osmanthus fragrans*, as horticulturists in this country know the *kuei-hua* of China.

The *kuei-hua* has as great popularity with Chinese painters as it has with people in general. It is one of the many flowering shrubs that we find portrayed, not only on scrolls but also on fans, those small expressions of the artist's brushwork.

In embroideries, sprays of *kuei-hua* appear as a common motif amongst other floral favorites. Sometimes it forms part of the decoration on embroidered sleeve-bands whereon elegant ladies wander through garden scenes. Here the flowers and shrubs, butterflies and birds are made with stitches that show infinite care and result in admirable realism.

We have not learned the flora of Chinese porcelains if we cannot recognize the *kuei-hua*, for it is seen on ceramics with as great frequency as in other branches of Chinese art. It may be neighbor to the chrysanthemum on a tea-cup; or it may share honors with peonies and orchids on a plate; or it may bloom between hydrangeas and poppies on a rice-bowl.

In one respect painters and craftsmen have failed. None of them has succeeded in depicting—or even in suggesting—the most important quality of the *kuei-hua*. Its ineffable fragrance has eluded the whole field of art, which is, perhaps, not surprising.

But fortunately we do not need to depend on art for our knowledge and enjoyment of the *kuei-hua*. As *Osmanthus fragrans*, it is available at the best nurseries in the Southern states and in California. It is of easy culture and especially satisfactory because of its freedom from plant diseases and pests. It develops into strong, erect shrubs ten to fifteen feet in height, ideal as background greenery for lower bushes and perennials. If planted to the windward, its subtle, breeze-borne aroma will spread over the entire garden. Then we will understand why the Chinese poet wrote of the wind and the *kuei-hua* in the same line.

Although *Osmanthus fragrans* is hardy only in regions where the temperature remains above ten degrees Fahrenheit, people in colder climates will be amply repaid if they raise fifteen to eighteen-inch specimens as house-plants just as the Chinese do. It is an invaluable conservatory plant—one which deserves to be much better known throughout the United States than is the case at the present time.

Pan of Kensington

By JOHN GALLINARI WHIDDING

Behold this book-born sprite, young Peter Pan,
Translated here with understanding art:
Soft-footed, gay of gesture, light of heart—
God of the woodland ways, and friend of man.

Caught by his piping music, clear and keen,
Fairies ascend the stump to seek his gaze;
All ages pause to smile or speak his praise,
But Peter stares across the Serpentine.

There float the haughty swans, so pure of poise
Even the carefree heart of Pan must burn:
Stricken in bronze, spellbound, he gives in turn
Enchanted dreams to all his girls and boys.

Tendrils

By ALEXANDER F. SKUTCH

THE DULL, uncultivated mind is interested in scarcely anything beyond the sensations of the body to which it is attached. As our spirit grows, it puts forth tendrils, which fasten themselves to things without us, whether to impersonal objects or to other minds. According to our nature, the tendrils we send out are either intellectual or esthetic, or a combination of both: some will fix themselves to surrounding things chiefly by knowing about them; others largely by bonds of feeling and sympathy. The greater our mental and spiritual capacity, the more numerous are the tendrils we develop, the more varied the objects to which they cling.

Youth is the proud and jubilant period of life, because it is then that these spiritual tendrils burgeon forth with the greatest frequency and ease. We experience a sensation of growth, of expansion, as at no other stage of existence. Almost daily we can point to some new acquisition of mind, to some new spiritual growth. Then we are rarely oppressed, and never for long, by that feeling of cessation of growth, of stagnation, which casts so dreary a shadow over all too many of our later days. Yet if we are wise, we shall see that this process of growth continues through all the years of our life. If the studies we have hitherto pursued failed to yield us new truths—doubtless not because we have sounded them to the bottom, but rather because we have run out all of our sounding line—then we should look about for new ones. If old enthusiasms grow stale, we must seek fresh interests. Perhaps it is a wise practice to acquire a new interest every few years, to the end that we may never lose the sensation of growth, and that our minds and spirits may never grow old.

The objects that stimulate the growth of tendrils are as diverse as the temperaments of men. Music, minerals, sculpture, snail-shells, art, ants, the stars, orchids, antiquities, mosses, butterflies, birds—the list is unending. Those pursuits are most to be preferred that favor the growth of tendrils compounded of both knowledge and feeling, for when formed by the interweaving of these two strands they are strongest and most enduring. Whatever class of objects produces these attachments—whether the stars that shine in the heavens or the mosses that form a green carpet over the face of a rock—should be treated with the utmost affection and respect, even with reverence; for it causes our spirit to stretch beyond ourselves, to send its tendrils groping through the vast mysteries of creation. Any study pursued with an earnest and enthusiastic mind, with love rather than gain or fame as a motive, is capable of producing this effect.

To those of us who love Nature in any of her myriad manifestations, no tendrils are so sacred and dearly cherished as those we attach to other living things. A garden, wrote Francis Bacon, "is the purest of human pleasures. It is the greatest refreshment to the spirits of man." And more than three centuries later, Donald Culross Peattie began his beautiful account of the lives and achievements of the great naturalists with much the same sentiment: "Of all things under the sun that a man may love, the living world he loves most purely."

These tendrils, which attach us to the objects of our love and contemplation, also furnish the strongest and most enduring bonds between mind and mind. In our business transactions with other men, we are motivated by love of gain; and all too often our profit is the other fellow's loss. In our social intercourse, too, we are much of the time ruled by the desire to dazzle, to dominate, to be considered more clever than Mr. X or more charming than Mrs. Y. But when two people who share the same enthusiasm for Nature come together, their conversation takes on a loftier, nobler tone. They forget self and all sordid advantages or gains, freely giving and receiving their toilsomely acquired treasures of knowledge and experience. And in giving no less than in taking they find their store of wealth increase, for old memories and the discoveries of bygone days acquire fresh life and heightened colors as they are recounted to a sympathetic mind.

These tendrils, these bonds of knowledge, of love

Portrait of the Artist

By HAROLD APPLEBAUM

I think that Nature must have been a child
Who splashed all day upon the drab new earth
With random brush and colors gay and wild.
She could not know the undiluted worth
Of red that made the cardinal's wing a flame,
That smeared the robin's breast, or blended quite
The bluebird's brilliant blue, but all the same
The air breathed color and the earth grew bright.
Perhaps, as any child might do, she found
A fav'rite shade—a green—and spread its hue
Where'er she went, on hills and trees and ground,
Until she tired at last and straitly threw
Them all together, blue and green and red,
To make a sunset ere she went to bed.

and of sympathy between ourselves and what is beautiful, lovable and true in the universe without us, form indeed the "flowery band to bind us to the earth." It is the severance of these sweet and tender bonds, far more than the separation of spirit and body, that makes death a gloomy and fearful thing to contemplate. We shall no more hear the blithesome songs of birds, nor look upon the stars, nor probe into the mysterious lives of insects, nor admire the works of the old masters, nor pore over the secrets of the ancient rocks. But ought not the very length and strength of these tendrils, the intensity of feeling with which we cherish them, the horror with which we view their severance, fill us with hope rather than with fear? We have grown out beyond the narrow limits of our bodies with their five senses, and sent our tendrils groping for support through the great universe beyond. The farther they have stretched, the greater their number, and the more varied the objects to which they have become attached, the more nearly we have approached to the divine nature which reaches and embraces all. And having so far outgrown the quintal or two of earth and water in which it dwells, may not the spirit perchance survive their dissolution, and continue to grow out and through the vast, unending diversity of the universe, until it reaches the Infinite, and becomes one with it?

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Stalked Puffball at College

By ELIZABETH EATON MORSE

CAN you imagine my surprise when I was told that *Battarrea*, which is really a puffball with a stem, known in the West as growing in sand dunes and deserts, had come up in a greenhouse at Wellesley College, Massachusetts? Desert conditions have been reproduced there, as nearly as possible, in one of the greenhouses.

In my effort to explain the surprising appearance of this fungus, for it is a fungus laboring under the technical name *Battarrea phalloides* Dicks. ex Pers., I proposed the following possibilities: spores (seeds), or mycelium (young roots), or even an "egg" may have been transported across the continent in packings wrapped around desert plants sent some years ago from our southwestern deserts, and planted by chance in a greenhouse there.

Unfortunately, when the specimen was collected by a student, the volva, which is the basal cup out of which the plant grows, was left in the sandy soil and could not be located. The specimen was forwarded to us to be compared with our *B. phalloides* and it was found to match perfectly. This Wellesley puffball measures nine inches in height; the head is one and five-eighth inches across. It may be seen in the Wellesley herbarium as number 3628.

One will be interested to notice how exquisitely the parts fit together in the "egg" (fig. 1); the volva is in the lower half, out of which grows a short stem, at the summit of which is attached the flattened, globose spore sac which fits into the two V's of the volva. This spore sac contains the fertile tissues, all embedded in mucus and enveloped in a double covering called the peridium.

There is a canal that runs through the entire length of the stem, also a slender cord within it. Just how the canal and cord function is not known.

When the plant is ripe, the peridium splits at the circumference (fig. 4), the upper half, cap-like, is released, it dries up and soon is blown away; the spores also are scattered by the wind. The spore sac, cinnamon colored, contains millions of spores and fungous threads. These last have spiral thickenings in the walls that are not understood.

There is great variation in the length of the stem according to the depth of sand in which the egg develops. The stem must keep growing until the head emerges above ground! The volva, usually heavily-sanded, also varies much. It may be globose, or tall and narrow, close-fitting, or broadly spread out, saucer-like (see illustrations 5, 6, 7). Some stems in large, mature plants are very shaggy. The extent of shagginess depends on the rapidity of the growth of the stem.

Battarrea is well known to botanists in the western states. With us it is a desert or dune plant and usually the sand is very deep. However, Mr. P. Marshall Rea, Santa Barbara, California, writes: "It has always seemed remarkable to me that this plant, in addition to its usual arid habitat, should also grow in humus in hollow oaks in England and France." It has been collected in the western United States in coastal regions from Oregon to southern California; inland, on Mojave and Colorado deserts; in New Mexico and Texas; also, at high elevations—at 6000 feet in Mono County near Mono Lake, California, by Herbert L. Mason, University herbarium. Giant forms are usually found in large collections; for example, Dr. W. H. Long found these in New Mexico, and E. A. Purer at Guadalupe, near West Santa Maria, California, Oct. 26, 1940.

Since the name *Battarrea* commemorates the early Italian botanist Giovanni Antonio Battarra (1714-1789)—his book was published in 1755 and the second edition in 1759—it seems appropriate that we adopt his spelling of the name, with two t's and two r's. Persoon, the author of the genus, omitted one t. This was an orthographic error which has been corrected by most writers.

attarrea phalloides. **Fig. 1. Early stage. The "egg." 2. Stem elongates, pushes up spore sac, patch of peridium adheres. . Cut vertically, shows outer and inner volva, canal, cord, spore sac (fertile). 4. Head of a robust plant, cap cracking, will e released. 5. Cap released (above). Volva globose. Stem shaggy, split and cut, shows canal and cord. 6. Double volva, road and spreading. Plant, short and stocky, grew in shallow sand. 7. Volva narrow, close-fitting. Plant tall, grew in deep nd. 8. Plant tall, slender, volva lost; from South Australia (Cleland). 9. Stem scaly, volva lost. Plant fully mature, fertile tissue lost, lower half of peridium intact (Cleland). 10. Under side of spore sac white, depressed around the stem.**

Rue Anemone

By EDWIN F. STEFFEK

FROM March to May—according to its location—the rue anemone, *Anemonella thalictroides*, bears its little white or pink-tinged cups on stems five to nine inches high. The flowers are much like those of the wood anemone, *Anemone quinquefolia*, but slightly smaller and borne several to a stem. The equally dainty leaves resemble those of the meadow rue.

This plant is a native of the thin, slightly moist woods, where it revels in humusy, well-drained soil along with the wood anemone. Once it was common from Massachusetts and New Hampshire south to Florida and west to Ontario, Minnesota and Kansas. Now, of course, it is gone from many of its old haunts.

However, the anemonella, as it is often called, is easy to grow from seed if sown in flats of finely-sifted soil as soon as ripe. Keep the flats in a sheltered place out of doors and where the seeds will not dry out or be washed out. Germination should take place the following spring. Then, with proper care, many of the plants should bloom the following year.

This plant can also be propagated readily by dividing the clusters of tiny, dahlia-like roots any time after the leaves begin to die down in summer. Each will make a new plant. In any event, top-dress both new plants and established ones with a light covering of leafmold every fall to keep the tubers from being uncovered in case there are heavy rains.

Since the leaves die down it is well to set the plants out in company with some of the daintier ferns, but, in any case, do not plant rue anemones where they will be crowded out by strong growers, and do not plant them too deeply if you want them to prosper.

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The Botanizer

By MARION DOYLE

Up in the mountains I went herb picking,
Met an old man, a rifle sticking
Aft and fore;
He looked to be a hundred years old—or more.
He was nothing much but knobs and angles,
Though his sly eyes sparkled like mica spangles.
His back was crooked under three coats,
His chin-whiskers waggled like a goat's.
He looked at my yarbs and squinted his eyes:
"Hey, young feller, kin ye Botanize?"

I told him what I'd learned of botanical knowledge
Down in The City at Big State College.
"Ho!" he laughed,
And shifted his chaw from fore to aft:
"So—thet's wat they larned ye?
Hit ain't surprisin—
But *I* wunt call *that* Botanizin!
My Granmammy larned me—she knowed each yarb
From th pizenest down tuh gyarden rhubarb."
He picked a leaf: "Know wat 'tis?
Wintergreen—cyore fur rheumatiz.
An this ree-ceipt un Injun give 'er—
May Apple Root fur uh sluggish liver.
Ef ye gotta asthmy, drink Wile Plum Bark—
But *be shore ye peel it wen th moon is dark!*"

Over the mountains we walked and walked
Till dark, and the old man talked—and talked.
He told of cyores by Black Haw and Poke,
Slippery Ellum and Jeerooslum Oak;
Devil's Shoestring and Male Fern Root,
Blessed Thistle—and a score to boot!
At last I said that I must go.
"Wall, cut yore stick, young feller," he said;
Pulled at his whiskers till they wagged his head:
"Wen ye've got yore Diplomy—*an think ye're wise*—
Come back an I'll learn ye tuh Botanize!"

To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

Velocity of Celestial Escape

By ISABEL M. LEWIS

Every celestial body, whether it be sun, planet, asteroid, or mere meteoric mass hurtling through interplanetary space, has what is known as its velocity of escape. This is a critical velocity that determines whether it may retain an atmosphere, or exert gravitational control over any object projected from its surface at high speed.

The greater the mass of a body, and the less the distance of the object from its center, the more difficult it is for that object to escape from its surface. The velocity of escape from the surface of the sun is 386 miles per second, which is the highest for any body in the solar system. Gaseous matter would have to be expelled from its surface with a velocity in excess of this to escape to outer space. At the earth's surface the velocity of escape is seven miles per second, and at the surface of the moon about one and one-half miles per second. On a small asteroid a stone could easily be thrown with a speed that would send it off into space never to return, and if one were able to obtain a foothold on a small meteoric mass that forms a part of the cosmic debris in the solar system it would be possible, of one's own volition, literally to jump off into space.

The velocity of escape of a body compared to the molecular velocity of the atmospheric gases determines whether or not it may hold an atmosphere. The molecules of the various gases in the atmosphere of a planet are all in constant motion at high velocities, continually colliding with one another and rebounding at high speeds like small elastic spheres. In the higher atmosphere, where there are comparatively few molecules and the free paths are longer, there are fewer collisions, and the molecular velocities are

higher. The higher the temperature of the surface of the planet, also, the higher the molecular velocities of the atmospheric gases. If the molecular velocities of the gases exceed the velocity of escape for the planet it cannot hold an atmosphere, and it is for this reason that the smaller bodies of the solar system do not have atmospheres. Even our own moon has not been able to hold an atmosphere permanently, although in the past, if it were a hot gaseous body, conditions would have been different.

The velocity of escape for the moon is about one and one-half miles a second, while the molecular velocity of hydrogen at zero degrees Centigrade is more than a mile per second; that of helium at the same temperature is eight-tenths of a mile per second; water vapor four-tenths; nitrogen and oxygen about three-tenths. If the temperature is 100 degrees Centigrade (and the temperature of the moon at the equator at noon rises to 110 degrees Centigrade) then the molecular velocities of these atmospheric gases are increased 17 percent. Calculations by Jeans have shown that if the mean molecular velocity is only one-third of the velocity of escape, the atmosphere would be reduced to one-half of its original amount in a few weeks, while if it were one-fourth the velocity of escape the time would be several thousand years. Our own planet with its high velocity of escape, has no difficulty in retaining even hydrogen. sand years. Our own planet, with its high velocity of its atmosphere, the intense heat on the side continually facing the sun, which is high enough to melt lead, accelerating the process.

Mars has been able, so far, to retain some atmosphere, including small amounts of oxygen and water vapor, but it is undoubtedly slowly escaping. The velocity of escape for Mars is about three miles a second. The velocity of escape for Venus is about the same as for the earth, and it has a dense atmosphere.

Jupiter, with its high velocity of escape of 37 miles per second, can easily retain a dense gaseous envelope. The same is true of Saturn, Uranus and Neptune, which have, respectively, velocities of escape of 32, 13, and 14 miles per second, and dense atmospheres composed of many gases and gaseous compounds.

Most of the satellites cannot have atmospheres, with the possible exception of the largest satellites of Jupiter and Saturn, which are larger than the moon. The planet Pluto, which is comparable to our own planet, Earth, in size, should be able to hold an atmosphere, because its velocity of escape should not differ greatly from that of our own planet, which is well able to hold a dense atmosphere. The great distance of Pluto from the sun, and the small amount of heat received from it, may have brought about the deposit of any oxygen or nitrogen, originally in the atmosphere, on the surface of the planet as solids or dense liquids. This would be true, also, of the planet Neptune, and, possibly, Uranus, as well, unless there is some escape of heat from the interior of these planets. Observations of Jupiter and Saturn show that these planets have dense and cloud-filled atmospheres of varied hue, indicating the presence of many gaseous compounds, and this is true to a somewhat less degree of the more distant planets.

Astronomer

By COSETTE MIDDLETON

Within his telescopic shrine he mans
The orbit of this new, gargantuan eye;
He pivots the exacting lens and scans
The spheric mathematics of the sky.
Coldly he contemplates the astral path
Of Betelgeuse, and reads the restless stars,
Comments on Vega, or a comet's wrath,
And calculates the parallax of Mars.
He fixes the routines of nebulae
And asteroids, and marks their stellar flight,
Compiles new laws and writes astronomy,
And then walks homeward through the clouding night,
Longing to speak to Galileo of
The snowflakes laying magic on his glove.

An interesting event on November 23 will be the occultation of the planet Mars by the moon. When the moon passes between the observer and a star, or planet, the object is said to be occulted by the moon. The disappearance of the body at the eastern edge of the moon is called the immersion, and its reappearance at the west limb its emersion. The times of the phenomenon, and the duration, vary with the location of the point of observation. The occultation may last anywhere from a second or two, in case of a grazing occultation, to more than an hour. The occultation of Mars by the moon will begin in eastern Canada and the northeastern states either before moonrise or shortly after, and the emersion will occur about 9:30 P.M., Eastern Standard Time. It will occur at Washington, D. C., at 9:29 P.M. This will be an interesting phenomenon, as the planet will be as brilliant as Canopus, or two and a half times brighter than Vega, and will appear on the dark west limb of the moon with startling suddenness at time of emersion, apparently hanging there for a second like a deep red protuberance. Mars is now rapidly decreasing its distance from the earth and increasing in brightness. It passes from Gemini into Cancer during November, and, by the middle of the month, rises about five hours after sunset.

Mercury will be at greatest eastern elongation on November 17, but will be low in the southwest at sunset and poorly placed for observation.

Venus is a beautiful object in the morning sky this month, but is drawing in toward the sun, and its phase is approaching that of full moon in the telescope. It rises less than two hours before the sun the middle of the month and (Continued on page 497)

The School Page

Edited by E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

ONE AND ONE MAKE TWO

THE closing game in our community league of backlot baseball teams was drawing to an exciting close, with my son's team with a one-run margin to overcome. Early in the game opportunities that did not seem to matter had been frittered away with a smile, but now the "pay off" was not far away. It was a hot day, and I thought of a case of pop that, honestly, I just happened to have in the back of my car. To add to the excitement I suggested to the teams that the winning team could have the pop. From then on there was as sweet a game of baseball as I ever saw. When the winners came to claim their reward, we passed it out to those with uniforms, and still there were a few bottles left. At the end of the line came a youngster with pants like his eyes—many times too big for him—and his eyes were glued to one of those remaining bottles. I asked him if he was a member of the team. With all the pride anyone could have in membership in any organization, he proudly said, "I'm the second assistant batboy." You may rest assured that he got his reward for work well done.

I wonder if this incident is not appropriate for repeating on a school page devoted to the problems of Nature study. I wonder if the second assistant batboys in the world of Nature—and of men—may not be of importance as they are in the world of boys. Some of our textbooks make much of such facts as that the longest plant in the world belongs to the algae, or there are more insects known to science than there are members of any other group of animals. What of it? Size and numbers and wealth are not the most important things in the world. That which makes an ecological society, an industrial plant, or a human community really function may be a second assistant batboy. Near my home there is a huge concrete plant that takes great quantities of limestone and shale from a hill immediately in its rear. The hill and the plant are spectacular, but none of them would be worth anything without a second assistant batboy—gypsum—that comes into the community unobtrusively on some cars. Added to what we can produce here, it makes a material of commercial value. Can we, in the pride of our contribution of bulk to this product, claim that we are the "whole thing"?

Look about you and see how many times you can find little things making important contributions to big things. We speak of a stream as being a good trout stream, overlooking the fact that it is a good trout stream because it supports important food for trout. We say that a wheat farm is a wonderful producer, overlooking the fact that the wheat that grows there was selected and developed in some laboratory by a little-known research worker.

Most of us fail to see how we can ignore the first lesson we learned at school—"One and one make two." We look about us in Nature and see the great masterpieces in any field produced as a result of recognizing the value of the addition sign. In Muir Woods we see trees that for more than one thousand years have been adding just a little wood each year. On the mid-West prairies, we see rich topsoils that we know were built up reasonably slowly over many years by addition of new topsoils. In a few spots in the East, we find intelligent farmers managing their soils so that their farms are adding each year a little new topsoil. We are, as children, told that we should eat our porridge, or drink our milk, so that we will grow up to be big folks some day.

I rather think that most Americans are respectable citizens anxious to do what they think is best for society. I rather think that most of us have bought government bonds and saved them, not because we were told that this was the thing to do but because we remember that first lesson we learned in school, and because we really believe it. We are neither fascist nor communist. We do not want to be president of anything, or lackey for anybody, but we do want to do our part and provide for our own future, and we want a reasonable recognition for the contributions we make towards happy living for all. We who are students of Nature know that any society is complex, and that no one of us can, by any stretch of the imagination, feel entitled to gloat over the assumed fact that no one in society is as important as we think ourselves to be.

In our humble way, most of us, in these days just after the war, wonder about a few things. We cannot understand how a principle of economics that we apply to our own personal affairs does not have some significance in the world of national and international affairs. We know that we cannot face an old age with confidence that we will not be a burden on our children unless we add, bit by bit, to our reserves. We know that when we are in trouble our substantial friends and relatives will probably be in the best position to help us meet emergency problems. We wonder how a nation that is assuming a place of world leadership can expect to hold it by dissipating its natural and pecuniary resources like drunken sailors on a V-day spree. If one and one make two for us second assistant batboys, how can one minus ten make two for all of us put together? Is there a law of economics as fundamental as the laws of science that most of us have learned to respect, and are there laws of society that we can have confidence will lead to happiness for us all? And if there is such a law, does honesty and fair dealing have a place in it?

A recent issue of *Time* lies beside me. In it is a picture of an eighteen-year-old youngster, who somehow seems to lack the qualities I think I have seen in the more substantial students who have gone through my classes and made fine wholesome records for themselves in the world of affairs. Yet we are told that she has just had a coming-out party that cost $40,000. We who have been counting our points, and living for the most part on hamburger a few times a week, and a bit of roast beef purchased at a restaurant once a week, wonder how this eighteen-year-old can have a spree where she entertains 600 guests and feeds them "sizzling rare cuts." It must have been strictly according to the regulations because the party was attended by the Secretary of the Navy, a famous ex-movie star and a former chairman of the Democratic National Committee and Postmaster General. We, who for years have had to refrain from asking a few guests to dinner at Thanksgiving time, or at Christmas, because we had to watch our points, wonder how anyone could entertain 600 guests with rare cuts while meat is still being rationed to us. Are we second assistant batboys getting the run around?

We are told that at this coming-out party they ushered in a new day of peace, and that it marked a scientific milestone since the grounds had been liberally sprayed with DDT. Those of us who have seen the reports of the studies made by the Fish and Wildlife Service of the effect of DDT on wildlife wonder if the liberal spraying of DDT on any open grounds is an index of our having reached a scientific milestone. Are we crazy to believe that one and one make two, we who could retire on what others use for a coming-out party for an eighteen-year-old youngster?

The nice part of it is that, in spite of all these questions that politicians and others raise in our minds, most of us remember that first grade lesson. Most of us know that for us, and we believe for others, there is more fun in building than in dissipating. We somehow just cannot get away from the conservation philosophy of the fundamental soundness of wise use. Those of us who are teachers recognize in the situation a real challenge to our abilities to show others the validity of what we know to be right. We can with every confidence march

up with the catcher and pitcher of the baseball team and announce that we are second assistant batboys and not be in the least ashamed of it. At least we earned our position by making a contribution to the good of the whole. We wonder if some of those who flash into the limelight periodically can honestly say as much. We know that they cannot. We know that growth and accretion are more wholesome than dissipation and exhaustion, and that one and one will always make two, no matter what the politicians try to tell us. We have a job on our hands, we teachers who are second assistant batboys, and we must continue teaching, in great variety of application, that first lesson most of us learned when we entered school. Nature is rich with examples that support our convictions.

WORLD OF A WILD BEE

(Continued from page 464)

Oblivious to both spider and larva, the alighting bee pushed its way into the entrance of a hole. Later, I saw it, with its flat face blocking the opening, resting inside, a quarter of an inch or so from the outer doorway. I passed my hand across the opening. The bee instantly backed farther into its tunnel like an alarmed fiddler crab. For hours at a time, the wild bees rest thus, at the same time guarding the entrance against intruders.

A little lower down the trunk, one bee, its rear legs and its underbody golden with pollen, remained motionless minute after minute. Around the outside of the hole, into which its head was thrust, was a fine, silvery coating of white as though paste had been applied to the edges of the opening. Bending close, I observed the aftermath of a little tragedy. The coating I had noticed was a webbing of silk that extended downward into the tunnel. Its maker was a small, six-eyed spider, *Ariadna bicolor*, that lurked within. The silk around the edges of the hole formed an alarm-system. Any insect that touched one of these star-points of silk automatically sent notice of its coming to the waiting spider. The bee had approached the hole with its load of pollen; it had touched the signal-strands of silk; and in a flash the spider had rushed forth and sunk home its fangs. The injected poison had left the bee paralyzed and helpless. The swiftness of the spider's movements I observed a little later when I saw another bee encounter the same fate. The spider appeared and disappeared so swiftly that its movements seemed but a gray blur.

The paralyzed bee, at the entrance of the silk-lined burrow, was seen by more eyes than mine. A black carpenter ant, exploring near-sightedly this way and that over the decaying wood, came upon this rich prize. It clamped its jaws on a hind leg and began tugging and jerking in an effort to dislodge the bee from the silk to which it clung with its grip of death. The spider made no appearance in spite of this violent hauling on the web. At last, the ant pulled the body of the bee loose and dragged it away down the treetrunk.

A little later, I discovered a carpenter ant that appeared to have fallen victim to one of the spiders. It lay at the entrance of a web-decorated hole with one middle leg moving feebly with short and twitching motions. A second carpenter ant came by, discovered the victim, and in great excitement tugged and pulled until it had it free. Then it did an astonishing thing. It dashed back to the hole and, standing as far away from the entrance as possible, began jerking violently at the silk. When no spider appeared, it ran about until it found a second hole surrounded by a similar web. Here it repeated its performance. If it were seeking vengeance, its efforts failed for in both cases the spider remained safely within the shelter of the burrow. And the ant made no effort to enter. Several times, I have seen *Halictus* bees approach a hole and then suddenly leap backward as though awakening to the menace of the silken border of the tunnel-entrance.

The breeze, drifting its apple-blossom petals down the slope, sent one of them spinning into the hollow of the cavern. It landed close beside a bee that clung to the upper wood. Frightened, the insect let go its hold, tumbled down on the brown material at the bottom, blurred its wings, righted itself, blundered into another bee and the two went tumbling in a miniature landslide out over the lip of the opening. They gained their wings as they fell. But a carpenter ant and a cherry-red mite that were caught in the cascading wood-particles went tumbling through the air to the ground. The excitement over, other bees that had taken wing returned to their labors.

As the insects beneath the surface pushed their way upward, darker material, deeper chocolate in hue, was carried to the top. This plowing and replowing of the area brought interesting objects to the surface. Here was a ball of pollen, an eighth of an inch in diameter. There was a glinting green fragment of the body of a dead bee. A little farther on was a black spear-shaped object which spread apart into three sections like the unfolding of a flower when I picked it up. It was the ovipositor, or egg-placer, of some unknown insect that met its death in the hollow of this wild-bee tree. A bit of whitish material that looked like tallow caught my eye. It was a nymph accidentally brought to the surface, a young *Halictus* bee partially through its transformation from the quarter-moon shaped larva—an eighth of an inch in length and a sixteenth of an inch in diameter—to the green-bodied, glinting-winged adult insect.

Around the decaying trunk, where these insects had established their community of burrows, revolved insect life of other kinds. A yellow-banded flower fly alighted on the "sawdust" and began stabbing downward with its stubby tail, depositing eggs of its own. Then, on wings that had a purplish sheen, it flew away. A little later, a great furry fly, the size and shape of a bumblebee, arrived with a droning buzz. It was that mimic-bumblebee, the robber fly, *Volucella evecta*. Like the flower fly, it had come to the decaying apple tree to lay its eggs.

A couple of hundred feet away, along the swamptrail at the foot of my hillside garden, a silver maple also had a cavern in its decaying trunk. But it attracted no *Halictus* bees, although, to my eyes, the conditions of decay seemed the same. Why they chose one tree and passed the other by is unknown to me. But at the tree of their choice, their constant activity continued week after week. As the apple-blossoms gave way to swelling fruit and the white foam of the spirea-like blooms of the wild cherries covered the bushes, the pellets of pollen changed from yellow to white. At first, only the golden pollen of the apple-trees was collected; then only the white pollen of the wild cherries. Later, as summer advanced, other pollens took their place in the sequence. On such fare, the young bees of a new generation reached their adult form. Hibernating females, when the next winter arrived, would carry the species over to another spring. By late summer, all the wild bees of the cavern had scattered. They were sleeping afield. And their moldering bee-tree on the hillside was deserted. The life of the strange *Halictus* colony had come to an end.

Silk for California

In March, 1943, the California State Legislature created an Assembly Interim Committee "to inquire into the possibilities of silk production and industry in California." Assemblymen John B. Pelletier, S. L. Heisinger and Elwyn S. Bennett were named to this committee, with Mr. Pelletier as Chairman. Hearings were held and a study of the subject made, resulting in a report to the Fifty-sixth Session of the Legislature recommending that it and the University of California give all encouragement and moral support "to any conscientious persons who have the vision to see and the courage to tackle this $1,200,000,000 post-war industry in California." The committee was convinced that the climate of California, existence of labor-saving machinery, the possibility of three crops annually, better quality silk, the lack of need for special skill and other considerations made a California silk industry feasible.

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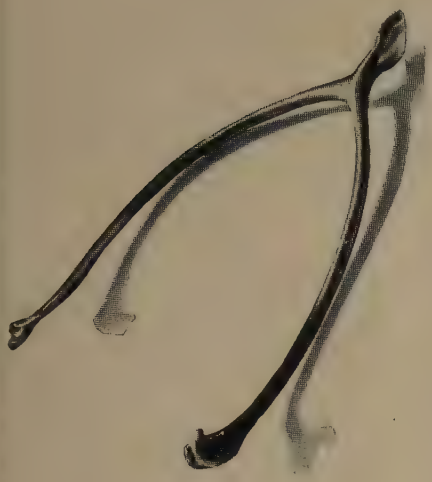

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BONE-BREAKING BIRDS

By CHAPMAN GRANT

One frequently sees mention that a swan or goose has broken, or is able to break, a man's arm or leg by a blow of the wing, usually referred to as "pinion" in these alleged cases.

I am not denying the truth of these statements, but I have been unable to run down any authentic cases. I have enquired from all of my bird-loving friends to no avail. Dr. Alden Miller, editor of the *Condor*, inserted a query in the March issue of this year asking for facts on the subjects; no answers.

It then occurred to me that surgeons would be the people who would know of such things. Consequently I spent a day in the excellent Medical Association Library in San Diego; to no avail.

A letter to the Library of the American Medical Association at Chicago brought this reply: "We regret that we are unable to supply you with references on the subject . . . fractures in man caused by wings of a swan or goose. We have no material on this subject in our library collection, which covers the past ten years only. . . ."

A letter from the Office of the Surgeon General, Army Medical Library, Washington, D. C., brought the following reply: ". . . We have been unable to find any accounts of human bones fractured by blows from the wings of geese or swans."

It thus appears that the burden of proof must rest with the writers who present unsubstantiated claims to broken bones, or who, with still less scientific caution, say that the birds "can" break a human bone. We leave the question with a request that any actual cases be reported to our Editor.

AVIAN TEAMWORK

By CHARLOTTE M. TEMPLE

The wren house on the lawn of Dr. W. I. Bartlett, professor of English at Roanoke College, Salem, Virginia, was the center of an avian commotion. Robins, sparrows, thrushes, and even a cardinal, were flying about in chattering excitement. Investigation was made and a snake found in the wren's nest. The nest was lifted out, the snake dispatched and the nest and young returned to the house. The mother wren fearlessly returned to her offspring, but showed her appreciation first by alighting on Dr. Bartlett's arm. The sounding of the alarm by the other birds, even including the much-maligned sparrows, was a real case of avian teamwork.

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GROW YOUR OWN FISH

(Continued from page 472)

of pond that has been fertilized. If the pond is unfertilized, reduce the number to four hundred bream and thirty bass fingerlings or fry. If you also want catfish, the above quantities are approximately correct, except that the bream are reduced to twelve hundred, and seventy-five catfish fingerlings are added in the fall, or as fry in the spring, to a fertilized pond, and a proportionate reduction is made in an unfertilized pond.

Of course, pond fish culture is not quite as simple as I have made it sound here. You have to keep a proper balance of fish feed, which means not only encouraging plant life, but also preventing the pond from becoming overcrowded with any one variety. If there are too many fish they will grow more slowly and will not become so large. That will result in hungry fish, but, although you may get more bites, the fish will be puny. If you want your bass and blue-gills to grow large and scrappy, do not permit them to become over-populated. This is a nice problem of balance, which is carefully set forth in the bulletins and books but which may not be quite so simple in practice.

Fertilizing a pond serves an added function of keeping down the growth of the larger and undesirable plants that grow both above and under water. It seems that a good growth of microscopic plants discourages the growth of the bigger ones. However, it may be necessary to pull up the coarser things by hand at times, or to mow them down. It used to be that we thought pond lilies and bull-rushes provided a good place for fish to hide—and so they do—but the new theory is that it is better not to have too many as they reduce the fish-carrying capacity of a pond. One way to reduce the number of pond weeds is to broadcast the fertilizer over the weed beds instead of in the shallower portions. But after the weeds start to die, no fertilizer should be applied at these spots as it may cause a fermentation that will use up the oxygen in the water and smother the fish.

Note: Literature on the stocking and management of fish ponds may be obtained from the U. S. Department of the Interior, Fish and Wildlife Service, in Chicago, and from the Alabama Agricultural Experiment Station, Auburn, Alabama.

THE ROBIN

By GEORGE R. HOPKINS

It is a lucky thing for the robin that he is protected by law, because I am in the mood to put him in the pot, not only because there is no chicken in that pot, but because I think he is a nuisance and a fake.

Until a few weeks ago I shared in the general belief that robin red breast was a harbinger of spring, an insect destroyer, a happy songster, and all that stuff. Come to think about it, some robins hang around Washington, D. C., all winter, so how can they be harbingers of spring? As for being insect destroyers, they have become so used to easy pickings on angle worms they are too lazy to hunt for insects; and as for singing, the occasional chirping they do sounds insipid with mockingbirds around.

I am an early morning golfer, who takes his eye off the ball quite often and lays it on Nature. Starting several years ago, I became greatly concerned over the slaughter of robins on the fairways. There would be a scattering of feathers and an occasional head. Except for one bluebird and one woodpecker the victims were always robins. Was it a cat, an owl, a hawk, or something else? My curiosity and indignation became so great I almost organized a pre-dawn hunt. Finally, the mystery was solved. I came over the brow of a hill just in time to see a medium-sized hawk land on a robin and give it the works. The "works" consisted of pounding poor robin against the ground with beak and claw. That explained the pile of feathers. This robin was borne away to the forest, but perhaps if I had not been advancing at my top speed it would have been eaten on the spot.

I consoled myself somewhat with the thought that perhaps that hawk would get a bill stuck in its throat. I also thought of that old one about Nature's balance. I became more solicitous of robins' nests in my yard. We had a cat (never again—but that is another story) which matured about the same time as a quartet of robins in a cedar tree, and so I built a wire barricade at the bottom of the tree. But a neighbor did not have such a barricade, so when said feline came tearing across the street with not one, but three young robins in its mouth, it signed its death warrant, executed at the Animal Rescue League next day.

Yes, I have been good to my robins. This year they took about half my cherry crop, which was small to start with. But the payoff concerned my plum crop near the front door. I am very fond of that plum tree, mostly because it is a flowering plum and not supposed to turn out a bushel or two of nice plums every year. Well, friend robin builds a nest smack in the middle of it and lays the usual bright, blue eggs. These were unusually bright because as I was dressing one morning there was a flash or two of black and away went sharp-eyed crow with a breakfast of raw eggs. Nothing daunted, the robins laid some more and sat on them the customary time. The plums ripened and started to fall off, many into the mouths of the paper boys, but did I disturb Ma and Pa? No, I waited until the young had flown before I picked the crop. Besides being overripe, about one in three had robin's bill marks deep in them and that was when I really turned against robins.

They run all over my lawn and pull up my angle worms, which I like because they benefit the soil. They eat my cherries, they eat my plums, and they would eat my strawberries if I had some. They fight with my mockers. They can not sing much; they are not too beautiful, they act afraid of Jap beetles, and they probably never heard of a Mexican bean beetle. In short, they are an avian washout, and I even prefer starlings.

Science in France

When the Germans broke through and approached Paris, some French scientists, for political or racial reasons, fled to unoccupied France, or to other countries. The rest turned back to their test tubes and formulae. Under German occupation they faced terrific obstacles. Materials were scarce or unavailable. While the Germans made no systematic attempt to block scientific research, there were frequent outbursts of persecution. Eminent scientists would be thrown into jail for weeks without charges, mainly to intimidate resistant scientists. Some were deported to Germany for actual or supposed political sympathies, connection with resistance groups, or other fancied offense. Two young physicists were killed, one by firing squad, the other by torture. Publication and diffusion of the results of research were stifled; no article written by or in collaboration with a Jew could be published; no Freemason could edit a publication or preside over a scientific society. Science could no longer be popularized. These restrictions forced French science into the resistance movement, where the scientist made weapons for the underground, notably the incendiary bottle that played an important part in the liberation of Paris. Through such a course science in France emerges from the darkness, strengthened by having maintained its freedom, even though under cover.

Lost Gold Mines

Thunder Gods Gold. By Barry Storm. Tortilla Flat, Arizona. 1945. Southwest Publishing Co. 166 pages. Illustrated. $2.75.

This is the story of gold and gold mines; of lost mines and mines refound. The author is a writer and adventurer who has followed the trail of gold, and the material he has gathered in this book results from his own roamings and information picked up along the way. Entertainingly and informally written, the text breathes of the West and its treasure-lands.

VELOCITY OF CELESTIAL ESCAPE

(Continued from page 492)

passes from Virgo into Libra. On November 6 it passes only three degrees north of Spica.

Jupiter also is in Virgo, and early in the month will not be far from Venus. It rises more than three hours before the sun by the middle of November.

Saturn rises in the east about four hours after sunset. It remains in Gemini, southeast of Castor and Pollux, changing its position little during the month as it reaches a stationary point in its orbit on November 6, and then starts to move slowly westward, or retrograde. In brightness Saturn is now about equal to Vega or Capella. It is a fine telescopic object as its rings are still tipped at a considerable angle to the earth. It is the southern surface of the rings that are now turned toward the earth.

The periodic swarm of meteors known as the Leonids has its radiant within The Sickle in Leo, and they will appear in considerable numbers from this direction in the small hours of the morning on November 15. A few may be seen on the night preceding or following this date, but this swarm, unlike The Perseids, is closely bunched in its orbit. The Leonids are intensely bluish-white in color and very swiftly moving.

Sweet Paraguayan

United States agriculturists working on a food-growing program in Paraguay have come across a wild plant that yields crystals many times sweeter than sugar. It is reported to be *Stevia rebaudiana,* a genus including about one hundred species of herbs found from Texas and Arizona south into South America. Experiments are being conducted in the cultivation of this sweet Paraguayan, which is now used to sweeten mate, Paraguay's favorite beverage.

Wallace Award

No more appropriate name could be chosen than the Tom Wallace Forestry Award for the prize contest established by Mark Etheridge, publisher of *The Courier-Journal* and *The Louisville Times.* This competition awards five hundred dollars in prizes to Kentucky and southern Indiana farm foresters who have carried through a complete forestry program this year, including protection, management and utilization of established wooded areas, as well as planting and protecting new forest tree seedlings. Tom Wallace is editor of *The Louisville Times,* long a leader in conservation, and one who has made inestimable contribution to public education in this field. Eloquent both as writer and speaker, he has long been an able missionary of conservation.

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THE DOCTOR GOES WILD

(Continued from page 484)

nudged me again and whined softly. If I still ignored her, she would jump up on the back of my chair and nuzzle me about the neck. If I continued indifferent, she nipped me lightly on the ear several times, growing impatient at my attitude.

Suddenly, a flip of her brush would cut me across the face, and she was on the floor. This was done with a slight show of temper, and generally brought results. But if I still refused to notice her, she would wander off into another room, and for several minutes not a sound would reveal what she was doing. Presently, something would crash on the floor—an ash-tray, or some other object. An expectant silence followed, while she peered in at me to note the effect of what she had done.

However, she still held a trump card. If I persisted in my apathy, she dashed into the nearest corner of the room, raced back across the floor, leaped into the air and kicked the paper or book out of my hand. Then, uttering a little squeal of delight, she stood obediently at my side, holding her head down for me to put the collar on her. After that, I could not refuse to take her for a walk. She had earned her reward by reasoning from cause to effect.

Sometimes, when Zorra grew too hilarious, we tried locking her in the bedroom at the cabin. But the plan rarely worked for she generally created such a rumpus by pulling the blankets off the beds, kicking the window blinds and sending them to the ceiling, leaping against the door and knocking things over, that we were glad to let her out.

Then she would most likely come scooting out into the front room with her nose buried in a shoe, sledding it across the floor before her. Wherever she had learned this, it is certain she never inherited the knowledge as an instinct.

Even so wily an animal as the raccoon often fell victim to Zorra's artfulness. If Bar-Rac was gnawing a pork-chop bone and Zorra had designs on the coveted morsel, it was no trouble for her to secure the feast. Taking up in her mouth some object with which the two were familiar, she would throw it into the air so that it fell on the floor near her pal. Unable to resist the temptation of securing the friendly object, the raccoon invariably lunged at it, dropping the pork-chop bone. In that instant, Zorra snapped up the prize, and Bar-Rac lost her dinner.

Zorra was always willing to please us in everything we tried to teach her. She would "play dead" whenever we asked her to, lying on her back, with all four feet in the air. Not an inch did she move until we told her she was free. She sat on her haunches with ease for minutes at a time, and walked about the room on her hind legs, balanced as gracefully as any trick dog.

Nor was Zorra lacking in imagination. She loved to pretend that some terrible thing was after her. Also, Zorra showed a fond affection for anything that she had ever possessed. Even if it were only a china goose egg—or some other object she had not seen for days, weeks, or months. When she had acquired it once more, she showed great pleasure. She would grovel and whine and rub her face over it with great joy. To take it from her would be to punish her.

Aside from the raccoon and bobcat, Zorra had other companions to play with from time to time. She made friends easily, for she was never treacherous. In the city, several of the neighborhood dogs became acquainted with her. And there was a little Boston bull that was on such cordial terms with our ward that we often permitted him to enter the pen and romp with her.

Zorra also had a hobby, or a miser complex. She was constantly hiding things, especially articles of food. Her favorite hiding places were under rugs, pillows, in corners of the rooms, and beneath pieces of furniture. Even in the ashes of the fireplace we found lost articles we had been seeking for days. When she began to make use of my bed for her caches, it was time to take a hand in the matter. To crush an egg, or roll on a soft tomato, on retiring, is no fun.

Certainly, in whatever Zorra did, she showed a high degree of intelligence. She could never resist the temptation to pursue a fleeing cat. One night, when out for a walk, we came fact to face with a large tom cat. With a venomous spit, the feline leaped around the end of the privet hedge to vanish in our neighbor's yard. At the same time, a gray streak of fur shot past me, and the soft rope burned through the palm of my hand.

But Zorra had not followed the cat. There was a hole in the hedge near the house, and through this she darted, silent as the moving shadow of a swooping bird. She had maneuvered so swiftly that the cat had no more than reached the opposite side of the hedge when she was before him. And I am sure that Mr. Thomas received one of the surprises of his life. Anyway, he leaped into the air and went elsewhere.

It was the cunning wit of the wild creature pitted against the less keen mentality of a domesticated animal. But our pet was capable of an even more deeper reasoning than this.

Among Zorra's favorite prizes were two condor feathers she had found along the trail during one of our strolls. She had taken a great liking to these feathers. She spent many hours playing with them; tossing them into the air, springing after them, and uttering little squeaks of joy. And to take one of them from her made her frantic with concern.

The first time this happened, Zorra did a clever thing. She was playing in the nursery one evening, when she discovered that a feather was missing. Instantly she conducted a search that led her into every corner of the room.

In the meantime, she had left the other feather lying on the floor. But when Mrs. Hoyt attempted to pick it up, the fox quickly retrieved the treasure and continued her quest, holding the feather in her mouth. Then Mrs. Hoyt revealed the fact that she had all the while been concealing the missing one behind her.

Zorra was greatly perturbed at the discovery, and, jumping into the air, she strove unsucessfully to dislodge it from the hand of her mistress with the stroke of a paw. She knew that she would lose the feather she held in her mouth if she let go of it, so, for a moment, she was in a quandary.

However, where there is the will of a fox there is always a way. The next second, when Mrs. Hoyt reached forward to tickle the fox in the face with the feather she held in her hand in hope that Zorra would drop the one that she was holding in her mouth, our pet saw her chance and acted in a flash. She let go of the feather she held in her mouth, and *standing* on it with her forepaws, she snatched the one from Mrs. Hoyt's hand so quickly that her mistress was chagrined by the ruse with which she had been outwitted.

Yes, the doctor went wild; but it was a wholesome wildness—one that gave us years of enjoyment and a deep understanding of the importance of all living things.

Poems Sought

We have a postal card from Artcraft Books Co., 545 Winchester Street, San Francisco 25, California, inviting poets to send up to four poems of not more than sixteen lines each for inclusion in an anthology. All styles and themes are accepted except humor. One hundred dollars in cash awards are offered and all poems are published free. That is all we know about it.

Maplewood Nature Club

R. J. Stein, Jr., of 17 Girard Place, Maplewood, New Jersey, writes us that the Northeast Nature Club of that community would like to add to its present roster of twenty-three members. The club has been going for four years now and has a regular field program. In winter each member has two zones in which he carries on wildlife feeding. The age of members runs from fifteen to nineteen, Mr. Stein writes, but adults are welcomed. There is a branch of the club in White Plains, New York.

MENOMIN, NATURE'S CEREAL

(Continued from page 466)

from the marshes, are used for planting by persons interested in increasing the food supply of wild ducks. For this purpose the grain is kept wet and held in cold storage. This process has been found necessary to preserve its vitality, which is soon destroyed either by drying or fermenting. In all, however, probably nine-tenths of this easily shattering grain is left for reseeding and for the waterfowl, which feed so eagerly upon it.

Wild rice or menomin is a true child of the marshes, and while it cannot live away from pure, circulating fresh water, and rich bottoms, it is the most productive and most valuable wild food plant we have. It is an ideal crop as neither the plow nor the hoe is needed for its production. Nature sows, fertilizes, and matures the grain; man needs only to reap. The time of the wild rice gathering, like that of other harvests, is one of much brilliant weather, fine hunting, and abundance of food. It was the heyday of the Wild Rice Indians, a season of life in its fullness, as described for us by Gordon, the poet of the Northwest.

"In the golden-hued wazu-pe-wee, the moon when wild rice is gathered,
When the leaves on the tall sugar-tree are as red as the breast of the robin,
And the red oaks that border the lea are aflame with the fire of the sunset,
From the wide-waving fields of wild rice —from the meadows of Psin-ta-wak-padan,
Where the geese and the mallards rejoice, and grow fat on the bountiful harvest—
Came the hunters with saddles of moose, and the flesh of the bear and the bison,
And the women in birchen canoes well laden with rice from the meadows."

We may be sure that these old Menominee—the wild rice people — enjoyed themselves hugely in their harvest moon, and for the time, at least, had no cause to envy, could they have known of, what we assume to be the superior advantages of civilization.

Types of Forest Cover

"Forest Cover Types of Western North America" is the title of a technical bulletin recently published by the Society of American Foresters, 835 Mills building, 17th Street and Pennsylvania Avenue, N.W., Washington 6, D. C. It provides a new classification that has been prepared in order to develop uniform terminology and usable standards for the whole western part of the continent, exclusive of Mexico. It is a companion to an earlier bulletin covering the eastern region. Copies are available at fifty cents.

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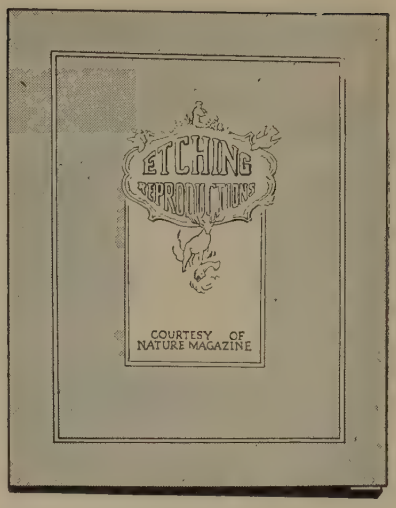

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"EVICTING" SEASHELL TENANTS

By CHAPMAN GRANT

The School page of the April *Nature Magazine* contains an interesting article on shells. Under "evicting a conch" Dr. Palmer says that the natives remove the animal by sawing off the end of the shell and that the animal is used for food. In the West Indies and Florida, and undoubtedly the Bahamas, also, the natives do not saw off the end of the spiral to remove the animal for food. They chop a small hole near the spiral and cut the tissue, which allows the animal to slip out. It is very difficult to saw a conch. When a horn is desired, which is seldom, the tip of the spiral is usually ground off on a grindstone. For horns the "horse conch" or Triton is used, although I once saw a common or pink conch, *Strombus,* that had been used in Kansas to call the farm hands to meals. When a perfect specimen of either species is desired it is hung mouth down and the animal slides out in a day or so. The horse conch is not considered edible. It feeds on the common conch. The latter is frequently fished up by the dinghy load to be evicted and searched for pearls, which are seldom, if ever, found. Some Key West characters carried a polished piece of pink coral to sell to tourists for conch pearls.

In Puerto Rico the aborigines used the conch for many domestic utensils. I have recovered the following articles from kitchen middens within the city limits of San Juan: A pestle, made by removing the outer whorls, leaving sufficient whorls for a good hand-grasp and polishing off the spiral. An awl, made by removing all whorls, leaving the central spire and using the spiral for the handle. A cup, made from the outer whorl or lip from which the rest of the shell had been removed. The edges were smoothed. A knife, made from the flat part of the outer whorl or lip. I have found "blanks" or "slugs" roughed out, ready for polishing. When finished, the knife is a double-ended chisel that nicely fits the hand. Great care was used in finishing this tool. I found hundreds of shells that had been discarded after the animal had been removed for food. This had been done by punching a small hole with the shell "awl" at the same spot where the moderns use their hatchets. The hole made by the aborigine was small and neat—about the size of the end of a lead pencil.

If you are not in the "know" a *Cyprea* is hard to evict. Boiling blemishes the shell and toughens the animal, making it hard to pick out. The native Hawaiian buries the shell in the sand for a few days, slit side up. He then takes a stout cord about ten feet long and ties a knot at one end. He slips the knot into the slit at the widest place and draws it in by placing the bight of the cord in the groove and pulling. Now the shell is firmly attached. He wades out into the water and swings the shell around his head as rapidly as he can and brings it down slanting to the surface of the water. A few such blows flushes everything out of the shell.

A TRAVELED PIGEON

By BEN CASSELL

A carrier pigeon attached to the Naval Air Forces of the United States recently claimed the distinction of finally delivering its message, after a journey of 4272 miles.

The pigeon was aboard a Navy blimp on patrol duty over the Pacific Ocean. He was released to carry a weather message back to Moffet Field, California, but as he winged his way back to the mainland, a storm came up and the bird was blown far out to sea. Nearing exhaustion, he saw a vessel bound for Honolulu and came to rest on its deck. The men aboard fed the bird and turned it over to naval authorities in Honolulu.

The Navy in Honolulu then crated the pigeon and returned it to Alameda, California, via the Air Transport Service. A sign on its crate read: "This pigeon is a member of the U. S. Naval Forces and is to be accorded treatment as such."

This roundabout journey did not affect the pigeon's infallible sense of direction. After landing at Alameda, the bird was gently launched into the air and he flew straight back to Moffet Field, which was thirty miles away.

BACKYARD OBSERVATIONS

By FRANKIE BLAKEMORE and MARIA WINEBERG

We hear so much these days about juvenile delinquency that we wonder if somehow the problem has spread to the bird world as well. Or has it always been there and we have just lately had our eyes opened to it?

Some robins nested in our yard this summer, and, in time, one fine baby robin made his appearance. Mother Robin, especially, devoted all her attention to him.

By now he has reached what might be termed, we suppose, his adolescent period. He is fat and healthy, and almost able to be on his own, but still requires the constant attention of Mother Robin.

A lot of maple seeds sprouted in our yard this spring, and the sprouts have reached a height of possibly three inches. Their spreading leaves make a fine cover and robin seems to prefer that spot to any other in the yard. He stands there, fat and sturdy, with his mouth wide open, demanding food all day long. Mamma runs and listens, gets a worm, stuffs it into Robin's throat; but he is never satisfied.

The other day she had fed him a lot of worms and finally decided she wanted one herself. As she was swallowing this especially luscious bit of worm meat, he kept his mouth open, evidently thinking it could not be possible she would eat anything herself when she had the privilege of feeding him! She kept right on swallowing the worm.

Robin, disappointed, neglected beyond the point of endurance, rushed up to her and pecked her. Mother, to discipline him and show him his place, landed squarely on his back and gave him a sound pecking. He endured it, as indeed he must, because she had him pinned down. When the "beating" was over and he was free, he chased her all over the back yard, pecking viciously and vigorously every time he came within pecking distance.

When he had finished disciplining Mother, he retired to the maple sprouts, and opened his mouth and stood waiting for a worm. Obediently, Mother scurried around to find more worms to feed him!

Another time, we threw a dried bun into the yard. Mother wanted some of that, too, but every time she came near to get a bite, Robin pecked her and kept it for himself.

So the daily drama goes on. Robin waxes fat on the fine food, and Mother grows thinner day by day hunting food and caring for Robin, the juvenile delinquent.

Galloway Writes 30

For twenty consecutive years J. C. Galloway has contributed a weekly Nature column to the *Port Allegany Reporter and Argus.* It was an informal, human column that appealed to young and old among his many readers. But Joe Galloway says that twenty years is a long time. He does not get afield as much as he did and writing has become more of a chore. So he regretfully has felt that he must write 30—the newspaperman's way of saying his story has ended—a decision reluctantly accepted by the publisher, Charles F. Boller. We have seen this column from time to time ourselves. It is the sort of column that, if one could appear in every newspaper in America, would make our country an even better and happier place in which to live. It was a local feature, drawing upon Nature as all the readers could easily find it right around them. It opened eyes to things too often unseen, so that they might lead the inquiring down corridors that would never otherwise be revealed to them. Readers of this Pennsylvania weekly will miss J. C. Galloway, but they may take solace from his suggestion that he might, from time to time, contribute a story. He will, never fear; newspapermen always do.

A Backward Glance

Editor, Nature Magazine:

During the winter I read an article in *Nature* describing an interesting experience with a hummingbird. It brought to mind a somewhat similar experience that happened many years ago, when an older brother and I caught two young hummingbirds and released them in the workshop where my father, with eight or ten men, were making shoes by the hand process of those days. That was at a time when the passenger pigeon had almost disappeared, although the chances for its reappearance were still being debated. The great herds of buffalos were a thing of a quite recent past, and the market hunter, backed by the transportation and wholesale market organizations, was carrying on his deadly work, which threatened with extinction other noble varieties of our wildlife. Every country boy had a collection of songbird eggs, perhaps to be traded for a jacknife with a broken blade, and we were constantly trying to capture rabbits, squirrels and woodchucks for pets, which usually died or escaped. Older boys and men were developing marksmanship for the fall hunting by shooting bats, swallows, blackbirds and even songbirds in the nesting season.

Some years later, when I, too, was old enough to have a gun, I went down to the millpond one summer evening for a little practice. The swallows were darting around over the water, and on my first shot one of them fell struggling to the surface. Immediately another, perhaps its mate, darted down and desperately tried to rescue the wounded bird. That happened sixty years ago but I have not got over it yet. I was not meant for a killer, it seems.

Be that as it may, with the background and atmosphere I have described it was to be expected that when my brother and I located the nest, just a lichen-covered nub on a limb, and saw the two tiny fledglings, we should mark them for our own when they became feathered and strong enough to live away from the mother bird. Released in the shop they showed no sign of fear of the workmen, and soon were lighting on their heads or shoulders, even occasionally on the haft of an awl, if the worker's hand was withdrawn for a moment. They quickly learned feeding time, and at my whistle would light on my hand to plunge their long beaks into the sugar and water in a thimble I held.

The summer wore away and the shop was cold at night and the birds deserted their roost on a curtain roll to hide away until the fire was started and the room became warm for the men in the morning. I should have released them, but good advice was lacking from my elders, who had all grown very fond of the birds —and what boy of nine would part with two such pets? Alas, a workman looking for something one morning before the birds had left their hiding place, in moving a box crushed and killed one of them, much to the sorrow of the gang. A month later, when changing from his street shoes to the old pair he worked in, he felt something in the toe of one of them. Yes, it was the last of my two delightful and interesting pets. They had seemed contented and to thrive on the artificial feeding. I have often wondered since, in these days of automatic heating, if hummingbirds would not live indoors indefinitely, although it would be cruel to deny them liberty.

JAMES D. MAHONEY

Brooklyn, N. Y.

Fishery Resources

Last winter Congress asked the United States Fish and Wildlife Service to make a comprehensive yet comprehensible report on the fisheries resources of the United States. This request has been met through publication of one of the best-presented and concise government reports we have seen. It is entitled "Fishery Resources of the United States," and consists of a large-size book of 135 pages, illustrated with modern graphs, and drawn and photographic illustrations. The text is direct and to the point, and the publication will be fully as much of value to school and interested individuals as it will be to members of Congress. It is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for forty cents.

Licenses Fall Off

Indiana, in common with other States, is alarmed by a falling off in the number of hunting and fishing licenses being sold this year. The Hoosier Department of Conservation reports $16,000 less revenue in June than the figure for 1944, and Milton Matter, director of the Department, calls the decline "disturbing in view of the fact that our fish and game program is dependent almost exclusively upon license receipts." A decline of more than 33 percent in the number of women taking out fishing licenses in Indiana is also reported. Even the Governor has been enlisted to sell licenses through a statement urging purchase on the ground that the license entitles the purchaser not only to hunt and fish, but "to a much greater privilege—the privilege of lending his support to the entire conservation program, which is largely dependent upon license sales." Which, of course, raises again our long-held contention that this is wrong in principle. Wildlife is the property of all the people of the State, and its protection and restoration should not be paid for—or controlled—by one segment of the population, but out of the public treasury.

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Under the Microscope

By JULIAN D. CORRINGTON

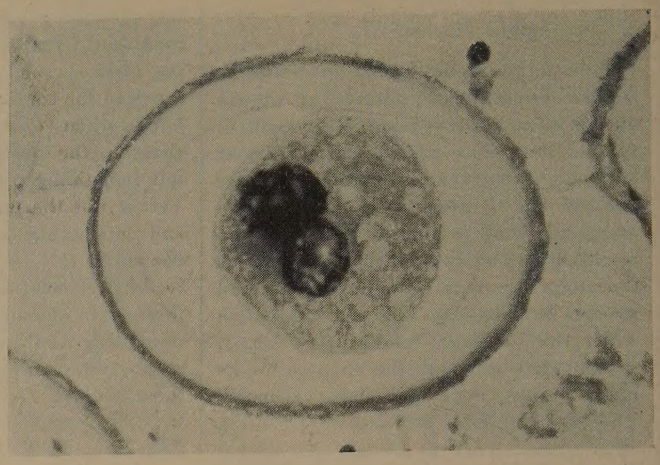
THE PHOTOMICROGRAPHS FROM SLIDES COURTESY OF WARD'S NATURAL SCIENCE ESTABLISHMENT.

FERTILIZATION

ADMITTING that hindsight is far easier than foresight, the modern student of science is nonetheless struck with the historical tardiness of numerous important achievements. We note so many remarkable discoveries by the Greeks of the Age of Pericles that it seems almost incredible they should have failed to establish the circulation of the blood, the law of gravity, and possibly even the invention of the microscope. Certainly that instrument should have followed hard on the heels of the spectacles and simple magnifiers of the late thirteenth century. But even after compound microscopes were in use, some three hundred years later, there was a lag of another two hundred years before the idea that organisms were composed of cells became current, following the publications of Schleiden and Schwann, in 1838-1839. A long list of late comers occur in other fields, including such important topics as the discovery of oxygen, making a science of chemistry possible, the succession of rock strata, and laws of plant hybridization. Even today we are ignorant of the full nature of light, of the virus, whether other planets or worlds are inhabited, and many items of knowledge that would surely seem easier of attainment than the release of atomic energy, even allowing for acceleration of certain practical lines in time of war.

Among major scientific discoveries, none shows a more conspicuous delay in arrival than the knowledge of fertilization, basic to an understanding of the reproductive process in plant or animal. Sex is today no mystery to any high school graduate, yet the simple facts taught in elementary biology courses have been known for less than the span of a single lifetime! Incredibly, they are no older than the telephone.

For thousands of years man has searched for the answer to this riddle. The ancients, as Aristotle, believed that the embryo formed as the result of a sort of coagulation or precipitation upon the mingling of two fluids, and this was as close to the truth as was possible until microscopes were available. To the male parent was assigned the entire role of propagation—the male engenders, the female merely nourishes. The great seventeenth century Dutch amateur, Leeuwenhoek, studied the sperm cells of animals in detail. Believing them at first to be "animalcules" resulting from putrefaction, he later regarded



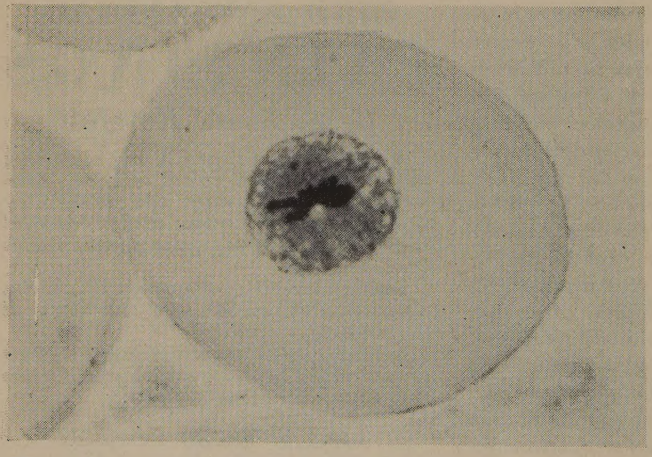
Pronuclei adjacent, Ascaris. Male and female pronuclei lie side-by-side in mature egg cell.

them in their true light as reproductive agents, and thought that he saw a miniature man or woman (homunculus) in the minute sperm cell. Thus the embryo was preformed in miniature and had but to grow, the egg providing a suitable nutritive environment. Others held that the homunculus was preformed in the egg, and thus arose a long controversy between the Spermists and Ovists, both sides championing the doctrine of preformation.

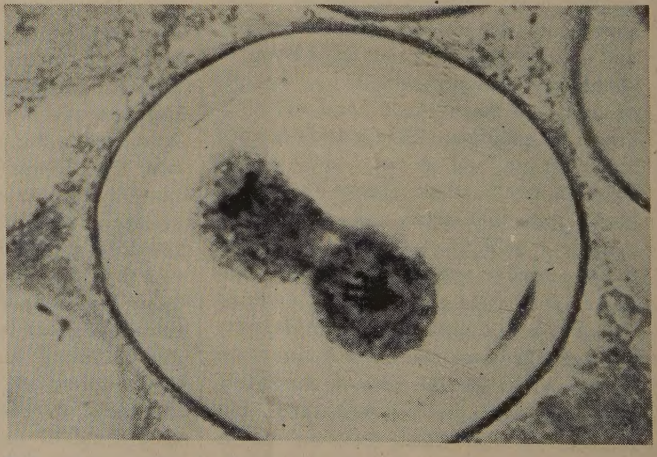
After the absurdity of this view was finally demonstrated, the opposite extreme, Epigenesis, was adopted. This idea, that the embryo arose from completely unformed material, was a revival of the beliefs of Aristotle and Harvey, and only subsided with a gradual increase in knowledge of structure of the cell.

By 1875 it was generally held that one or more spermatozoa probably entered the egg cell, but the role they played was nebulous—possibly the sperm initiated some sort of chemical or physical stimulus whereby the egg began to cleave; the egg itself was formless, even—said some—lifeless. By 1875, however, the stage was set for great although ever so tardy cytological discoveries: microscopes had been vastly improved, sectioning methods were known, and textile dyes had been appropriated by the biologist; the cell was considered as a structural unit of organisms. Now there occurred a series of brilliant researches aimed at elucidating the purpose of that spherical body, the nucleus, that seemed to be floating near the center of cells, but which disappeared from time to time, and whose function was utterly unknown. Likewise there were important investigations along similar lines and by some of the same people, designed to solve the problem of the initiation of life.

In 1875, Oscar Hertwig, elder of two famous German brothers,



Metaphase, first cleavage division. Of the four chromosomes, two from father, two from mother.



Telophase, first cleavage division. Each daughter cell has full complement of four chromosomes.

elected sea urchin eggs as suitable material for work in this field, and announced that fertilization consisted of the union of male and female nuclei. In this same year, the Belgian, Edouard van Beneden, saw two nuclei in the fertilized mammalian egg and guessed that one was of male, the other of female, origin. In 1875 also, Edouard Strasburger described the main features of mitosis in plants, with further particulars in 1880. Walther Flemming went on to detail and name the parts and phases in animal mitosis, and gave the term *chromatin* to the deeply-staining substance that forms first threads and then shorter, thicker bodies. These last were named *chromosomes* by Waldeyer in 1888.

Van Beneden discovered research material of the greatest importance in this line of investigation when he sectioned the eggs of *Ascaris megalocephala,* roundworm parasite of the horse. This lowly creature was destined to add the final and conclusive chapter to man's search for the answer to the age-old mystery of fertilization. Whereas the ascarid parasite of man or of pig has 48 chromosomes in every body cell, that from the horse has only 4, a number so small that each chromosome may be followed individually throughout successive life cycles. Van Beneden published his results from 1883 through 1887 and showed that all somatic (body) cells of this worm have four chromosomes, the mature germ cells but two, so that upon fertilization, the two brought in by the sperm are united with the two retained by the egg to restore the somatic number of four; this is his famous law of the equal contribution of the two parents, announced in 1883, and dispelling forever the previous illogical notions that one parent was more "potent" than the other.

Both the egg and the sperm must undergo, in their maturation processes, a reduction division wherein the four chromosomes in their respective parent cells become reduced to two. This specialized form of mitosis, today termed meiosis, will be described in later articles.

The genetical term for the somatic number of chromosomes is *diploid,* for the reduced number in the germ cells, *monoploid.* The reduction division is the essential mechanical explanation of Mendel's law of segregation and makes possible a demonstration under the microscope of the truth of many theoretical interpretations of results of plant and animal breeding. Van Beneden's studies have not received the general attention they deserved; you will look in vain for even mention of his name in most texts. Actually his announcements were epochal, and paved the way for a scientific approach to the greater and still more baffling problem of heredity.

Meiosis may be studied in various subjects, but is grasped most easily from *Ascaris* preparations. As the eggs of this worm mature, a protective shell of increasing thickness and toughness forms around them and soon they become extremely difficult to fix properly or to cut on the microtome knife. The technique involved in order to secure good mounts is beyond the average technician, but excellent slides are obtainable from all main biological supply houses, and readers are advised to add this item to their collections by purchase.

The sperm enters this egg precociously and waits in relative inactivity until the egg has undergone its two maturation divisions, one of which is reductional. From the sperm nucleus, now an enlarged spherical body called the male pronucleus, there appear two long chromatin threads that slowly condense into the two paternal chromosomes; likewise the egg nucleus forms the two maternal chromosomes. At the period generally termed "pronuclei adjacent" the two pronuclei may be seen side-by-side, each with two chromosomes in one of the several phases of their formation. In our illustration of this stage, the two pronuclei are conspicuous, but their chromatin strands have not yet condensed.

The membranes limiting these pronuclei now disappear, liberating the four chromosomes into a common cell cytoplasm; they proceed to line up on a common mitotic spindle, this act being the essence of fertilization. At no time do either the nuclei or the chromosomes "fuse", a much-abused term in discussions of this subject. The chromosomes are aligned at the metaphase of the first cleavage division (second illustration), then each splits longitudinally so that each of the two resulting daughter cells (telophase, third illustration) receives exactly the same complement, one set of two paternal and two maternal chromosomes. The active inception of the life of the new individual may be said to begin with the metaphase of this first division, when chromosomes from the father go onto the same mitotic spindle with their mates from the mother.

HISTORICAL OUTLINE

We have noted the smear technique and staining procedures followed by the young doctor, Robert Koch, in his pioneer work in learning to capture and handle bacteria. More important was his invention of culturing methods. In a fluid medium, as beef extract, bacteria would grow and flourish, but could not be isolated to form pure cultures. If some of this material was injected into a test animal, and a disease resulted, no one could be certain which of the several kinds of bacteria present, if any of them, actually caused the disease. To *prove* that a certain species of bacteria was the etiological agent or pathogen of a given disease, it was essential to introduce only this

References for the Microscopist

(Third List)

In previous issues we have offered a number of important texts and reference works on the microscope, microtechnique, and various background sciences. This third listing includes five additional subjects, all of them important to the microscopist who wishes to build on firm foundations. We suggest you add some of these titles to your library; mention them to friends and family as suitable remembrances; note them as gifts for that fellow microscopist.

CRIMINOLOGY

Finger Prints, Palms and Soles, by Cummins and Midlo. New and complete general work; all aspects of subjects, criminological, biological, historical ----------$4.00

EMBRYOLOGY

Fundamentals of Comparative Embryology of the Vertebrates, by Alfred F. Huettner. Best and most recent general comparative text, beautifully illustrated ----------$4.50

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A Text-Book of Histology, by J. Lewis Bremer. Fifth edition of one of the most widely used standard texts ----------$6.50

Handbook of Microscopic Characteristics of Tissues and Organs, by Karl A. Stiles. Practical laboratory companion for identifications ..$1.50

MYCOLOGY

Textbook of Mycology, by E. A. Bessey. Complete work on classification, structure, life histories of the fungi ----------$4.00

The Advance of the Fungi, by E. C. Large. Important and fascinating account of warfare between fungi and man; how fungi have shaped human civilization; for readers of all classes ----------$4.00

PARASITOLOGY

Parasitology, by Hegner, Root, Augustine, and Huff. Comprehensive coverage, authoritative, highly interesting ----------$7.00

Clinical Parasitology, by Craig and Faust. Medical reference work on parasites of man; recent, exhaustive, standard ----------$9.00

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species and to rule out all other possible causes.

Joseph Schroeter had, in 1872, published a paper on the use of potato, bread, and other solid media in the study of pigment-producing bacteria. Also in this same year there appeared Oscar Brefeld's article on his use of gelatin for solidifying liquid media. Koch now perfected and brought such methods into general use. In 1881 he introduced gelatin as a medium, mixing it with bouillon or other liquid in which bacteria could thrive. This could be made solid or liquid by slight alterations of temperature. He had noticed the growth of colonies of bacteria on the cut surface of a potato, and that when a tiny loopful from a pink colony on a potato was cultured in sterile broth, an immense number of bacteria resulted, but all of a single species. Similarly, a loopful from a yellow colony resulted in prolific growth of a second species, but each colony produced bacteria of only one kind; in other words, a colony represented a *pure culture*. Koch reasoned that as bacterial spores fall into a liquid medium from the air, they multiply but intermingle, so that the liquid will soon teem with many individuals of mixed species, inextricably confused; but if a single spore falls upon a solid medium, as a surface of cut potato, it is not free to become mixed with others, but sticks there like a fly trapped on sticky flypaper. All of the individuals that there germinate to form a colony visible without magnification result from fission from a single original spore. Colonies are therefore pure, and hence there is an enormous advantage to being able to raise them on solid media.

Frau Hesse, the wife of one of his students, suggested substituting agar for gelatin, with marked advantages; the agar is transparent and colorless, like gelatin, but is not liquefied or digested by bacterial action, and will not melt at low temperatures. It must be raised to the boiling point to melt, but will not then set until cooled back to body temperature. Adoption of this derivative of seaweeds accomplished notable improvements in methods and agar has not been supplanted to this day. Incidentally, it has been a high priority item during the present war, since the Japanese had built up a virtual monopoly in this commodity, so essential to our hospitals and medical laboratories.

Another student of Koch's, R. J. Petri, suggested the culturing dish that bears his name and is still standard in all laboratories. Koch had at first poured his melted media onto sterile glass plates, covering these with a bell jar; but the fluid ran over the edges of the plates, and such cultures could not be incubated unless uncovered and exposed to contamination. The petri dish solved these difficulties, and remained unimproved until very recently, when one firm introduced a slit in the side through which an inoculating needle could be introduced without uncovering the agar plate.

TRADE NOTES

Photomicrography

Adopting as his basic premise that the products of a man's work can be no better than his knowledge of the tools used, Charles P. Shillaber's *Photomicrography in Theory and Practice* puts the reader through a very thorough course in the optics and mechanics of the microscope. In discussing such a topic, for example, as resolution, a careful explanation of that factor is made and illustrated by diagrams, its theoretical implications are followed by practical applications, and examples of photomicrographs of the same subject with proper and improper attention to resolution are given. Whether or not the student is interested in photomicrography as such, he is certain to profit by the detailed and explicit treatment of such matters as alignment of parts, construction and functions of all apparatus, the many factors pertaining to correct illumination, and so on.

Designed as a reference manual, this volume is also a most valuable text. It contains the results of years of teaching as well as practice, and we are therefore not surprised to observe the inclusion of laboratory exercises and lists of questions for self-testing on achievement. There is a full discussion of oculars and objectives, condensers, filters, and illuminants, cameras, developers and exposure times, and of reagents employed in microscopy, especially stains and mounting media. The volume ends with a comprehensive chapter on an analysis of practical photomicrographical problems, covering 147 pages, and considering the photography of all important industrial and biological specimens, with numerous illustrations. Both the diagrams and photomicrographs are exceptionally well selected and executed, and there is a glossary of unusual clarity and completeness. This is a must for all photomicrographers and is highly recommended for other microscopists. Pp. viii, 773; figs. 291. John Wiley & Sons, Inc., 440 4th Ave., New York 16, 1944. $10.00.

Parasitology

One of the most beautifully and thoroughly planned and executed biological works we have ever seen is the *Manual of Tropical Medicine*, a military medical manual of the National Research Council, prepared under the auspices of the Division of Medical Sciences, with a long list of notable editors, authors, and contributors. Conceived as a comprehensive guide and text in tropical medicine for use by all branches of the Armed Forces of the United States, this work takes its place in a world now at peace as a most valuable addition to the libraries of all physicians, biologists, microscopists, and others whose chief interest is in parasitology.

The numerous sections consider the virus, rickettsial, spirochetal, bacterial, mycotic, protozoal, helminthic, and nutritional diseases, miscellaneous conditions, medically important arthropods, and laboratory diagnostic methods. Under each specific topic, such as hookworm disease, the headings are: synonyms, definition, distribution, etiology, epidemiology, pathology, clinical characteristics, diagnosis, treatment, and prophylaxis. Each of these is considered as briefly as is consistent with sound and sufficient coverage, and the text is accompanied by illustrations of extraordinary value. These include distributional maps; photomicrographs of the parasites, their life cycle phases, and characteristic lesions of affected organs and tissues; photographs of clinical pictures and, as one of the most noteworthy of new features, modern poster-style charts that show, as a limit illustration, the life cycle, parasite in various stages, vectors, reservoirs, hosts, methods of infection, and epidemiology. Tables and taxonomic and phylogenetic charts are among other condensed forms of presenting the wealth of detailed information found in this amazing volume. Pp. xix, 727; figs. 284. The W. B. Saunders Co., West Washington Square, Philadelphia 5, 1945. $6.00.

MICROCENTENNIALS

Hermann Fol, distinguished Swiss zoologist, was born in Geneva in 1845, the son of wealthy parents of German descent. He took his M.D. at the University of Berlin in 1869, but devoted his life to zoological studies, notably in the field of marine zoology. As he was a man of wealth he was able to indulge his tastes along these lines, establishing the marine laboratory at Nice, and outfitting his own yacht for scientific expeditions.

Dr. Fol was professor of zoology at Geneva for nine years. He published important works on comparative histology and embryology, and played a part in the most important of all series of researches that grew out of the announcement of the cell doctrine in the earlier half of the 19th century—the elucidation of the process of mitosis, and the fertilization of the egg. Fol observed certain of the isolated details of mitosis, and enjoyed the distinction of being the first person in the history of the world ever to see the actual penetration of an egg by the spermatozoon.

This eminent scientist is remembered for one other curious and tragic event. In 1892 he set forth on a voyage of research in marine zoology, but Fol, his vessel, and his entire crew disappeared utterly, and were never heard of again. *Spurloss versenkt!*